

Amphibians and reptiles from Lawachara National Park in Bangladesh

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Abstract

An annotated inventory of the herpetofauna of Lawachara National Park in Bangladesh is presented, based primarily on original field observations recorded during a six-year survey of the park. A total of 71 species are reported, including 19 Anura, one Apoda, two Chelonii, and 49 Squamata. The course of the survey revealed 16 range extensions including 11 new country records for Bangladesh. Eight of the 16 range extensions including six of the 11 country records are reported here for the first time. Deleted from previous Lawachara National Park checklists are 23 species that had been erroneously reported due to misidentification or the splitting or synonymization of species.

Keywords

Caecilians, frogs, habitat degradation, lizards, snakes, species richness, turtles.

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Introduction

Knowledge of the herpetofauna of Bangladesh is poor in comparison to that of other Asian countries and in particular its neighbors India and Myanmar (Mahony et al. 2009; Rahman et al. 2019). Until recently, the herpetofaunal assemblages of many of the protected natural areas of Bangladesh were largely unreported, with the first attempt to detail species lists for these regions made in Khan (2008).

Lawachara National Park (LNP) is a 12.5 km² nature reserve in the northeast corner of Bangladesh on the western cusp of the Indo-Burma Biodiversity Hotspot, where

a confluence of diversity occurs as the biogeography is of both Gondwanan and Laurasian origin (Reza 2010). Park officials installed signage in 2009 stating that the park contained four species of amphibians and six species of reptiles, in contrast to 246 bird species. This remarkably low estimate appears to have been based on a 2003 report by Nature Conservation Management (NACOM 2003), and those figures continue to be cited in published papers (Haider and Kabir 2014; Sohel et al. 2015). Reza and Perry (2015) expanded substantially on this base by producing a species list for LNP of 15 amphibians and

43 reptiles. However, this list was based on unvouchered records and appears to include several misidentifications (AHM Ali Reza pers. comm.).

In 2011, the Creative Conservation Alliance embarked on a six-year (2011–2017) survey of LNP. This park was chosen for our site due to its proximity to the capital Dhaka, the existence of promising tracks of secondary habitat, and the potential to produce new species as it had not been extensively surveyed.

In addition to surveying for species presence, we made a point of tracking the regions of the park within which each species appears. The forests of LNP have undergone significant habitat degradation over the last century which has affected different regions of the park to varying degrees. The successional habitat changes that follow anthropogenic forest degradation are known predictors of amphibian and reptile distribution (Lamb et al. 2005). Increased degradation of habitat has been found to lead to declines in species richness (Pawar 1999; Wind 2000; Schulze et al. 2004; Harvey et al. 2006; Gardner et al. 2007; Basset et al. 2008; Philpott et al. 2008; Ernst and Rodel 2005, 2008; Wanger et al. 2010), though the particular type and length of habitat degradation and reclamation can mitigate negative outcomes (Schmidt-Vogt 1998; Wanger et al. 2010; Folt and Reider 2013). In order to investigate the potential impact of this degradation, we classify habitats based on their land use histories and delineate which habitats are frequented by each species.

Monitoring the ongoing relationship between herpetofauna and the people of the villages bordering LNP was vital to our study. Over the course of our survey we engaged with local residents in education, conservation, and predation mitigation efforts.

Methods

Study site. Lawachara National Park is situated in Moulvibazar District of Sylhet Division in the northeast of Bangladesh (Fig.1). It is a 1,250 ha mixed-evergreen forest characterized by an undulating landscape, with slopes and hillocks at an elevational range of 10–80 m above sea level. Several small streams and ponds are distributed evenly throughout the park. Most of the original forest cover has been altered or substantially removed by crop rotation with only remnant patches of primary forest remaining (NACOM 2003). The region has a tropical monsoon climate, with average annual rainfall of approximately 4,000 mm, of which 80% falls from May to October (Quazi and Ticktin 2016). October to March is dry with the first rainfall usually in April. The annual mean diurnal temperature ranges from 32.9 °C (April) to 9.5 °C (January) (Quazi and Ticktin 2016).

Several types of habitat degradation are present in LNP. Rahman et al. (2013b) grouped these into the following five categories based on their land use histories:

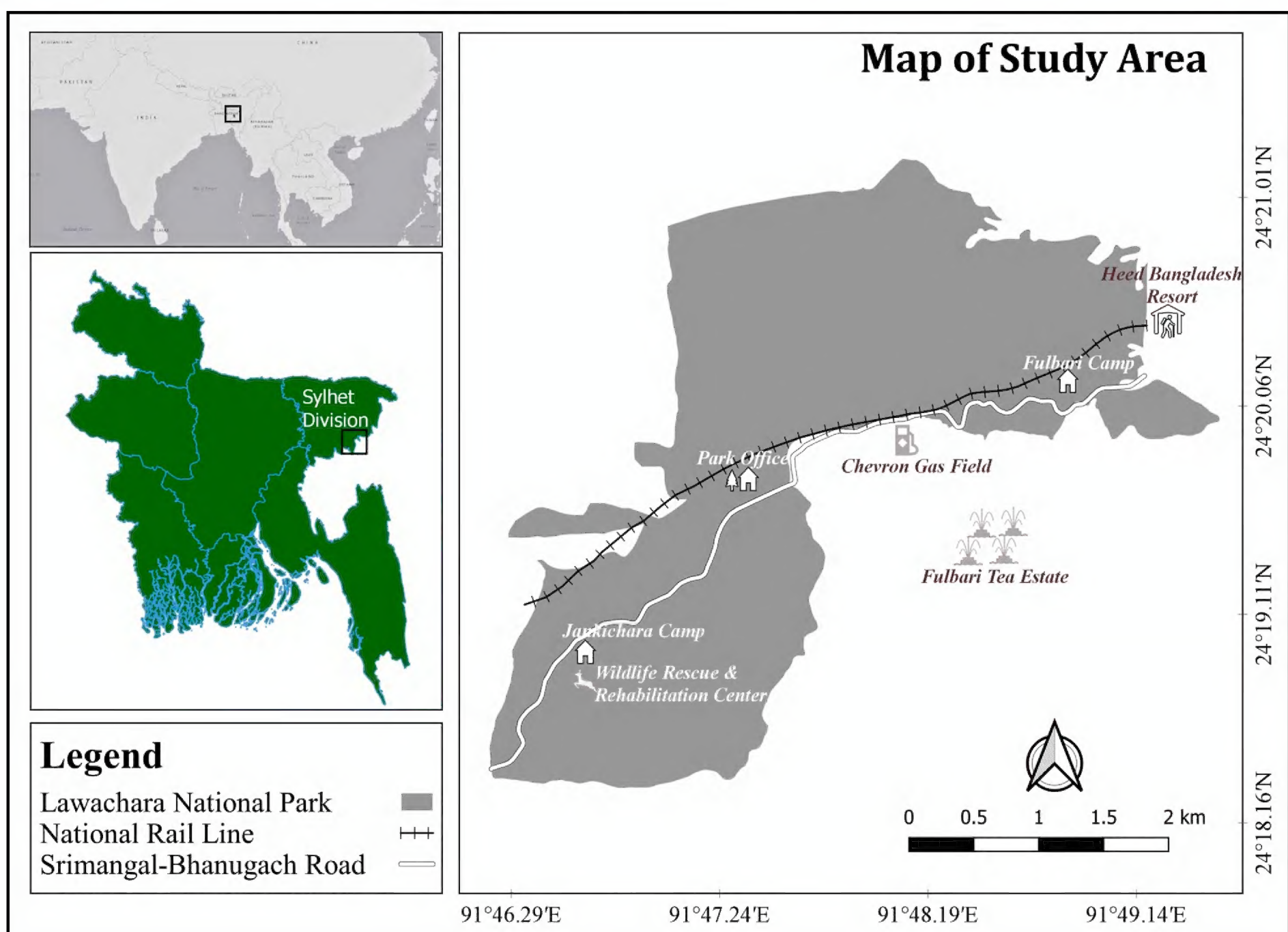


Figure 1. Map showing Lawachara National Park in national and divisional context.

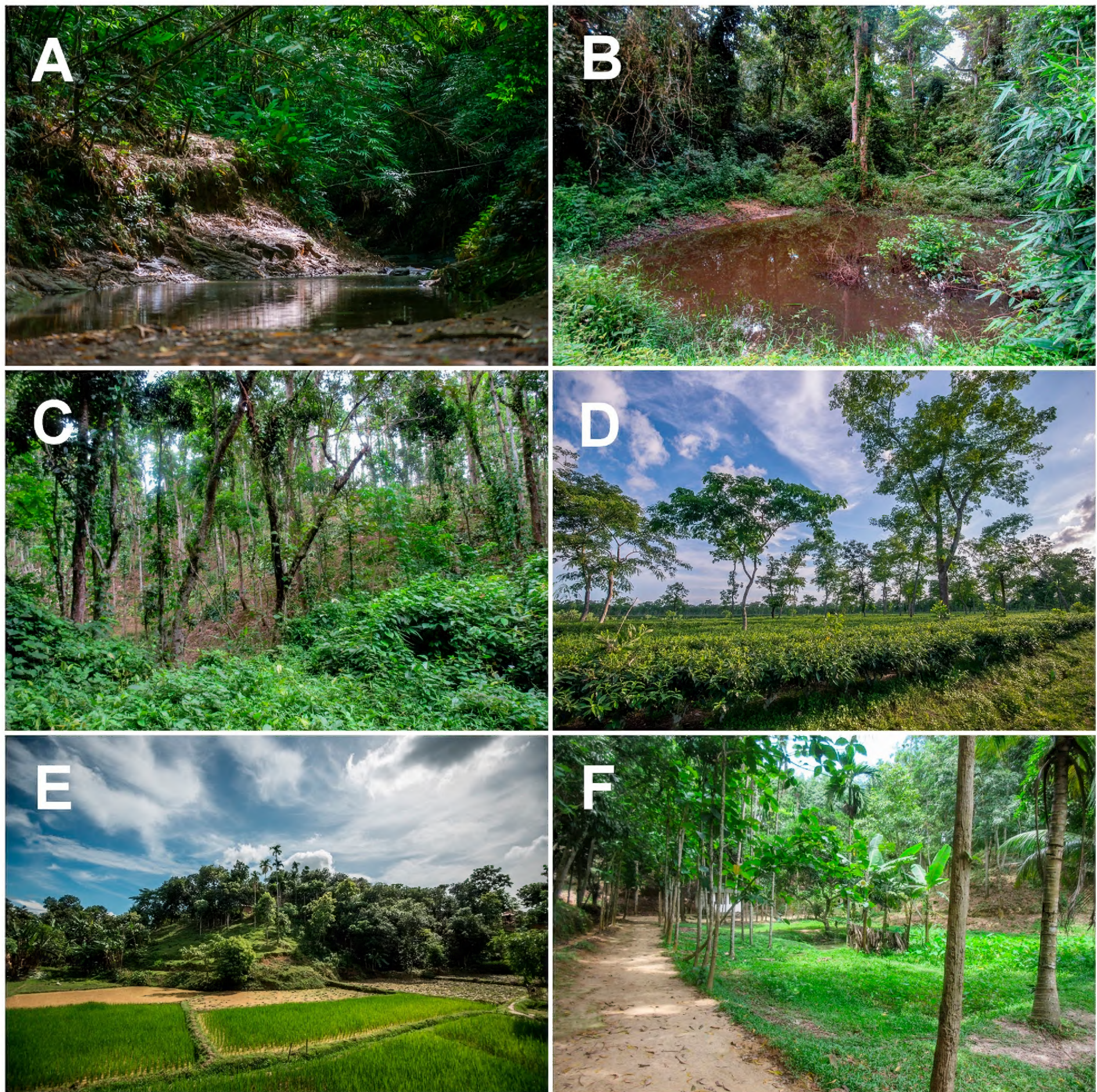


Figure 2. Land use types described in Study Site. **A.** Mature forest. **B.** Mature forest. **C.** Degraded forest. **D.** Tea plantation. **E.** Paddy fields. **F.** Village habitat.

mature forest, degraded forest, tea plantation, paddy fields, and village habitat.

“Mature forest” (Fig. 2A, B) is defined here as dense secondary forest which was used as tree plantation in the 1920s–1960s for species such as *Tectona grandis* L., *Dipterocarpus turbinatus* Gaertn., *Lagerstroemia speciosa* (L.) Pers., *Xylia xylocarpa* (Roxb.) Taub., and *Neolamarckia cadamba* (Roxb.) Bosser. The canopy in this forest currently consists of *T. grandis*, *D. turbinatus*, *Artocarpus chaplasha* Roxb., *Elaeocarpus floribundus* Bl., *Dillenia pentagyna* Roxb., and *Castanopsis tribuloides* (Sm.) A.DC. (NACOM 2003). Less than a third of LNP is “mature forest” under this definition (NACOM 2003). Within this area are several sandy seasonal streams and small ponds.

“Degraded forest” (Fig. 2C) is defined here as more

recently degraded secondary forest which was used as plantation in the 1970s to the present day, generally for species such as palm, *Aleurites moluccanus* (L.) Willd., and *Acacia* spp. Martius, and retains none or only up to 5% of original native tree cover. At least 100 ha of this degraded forest has been converted to betel vine (*Piper betle* L.) plantation by Khasia villagers. This forest also has sandy seasonal streams and ponds.

“Tea plantation” (Fig. 2D) is dense tea (*Camelia* spp. L.) plantation with sparsely planted mature trees (*Samanea saman* (Jacq.) Merr., *Eucalyptus* spp. L’Hér., and *Acacia* sp.) that provide shade for the tea plants. The tea estates are not part of LNP proper but compose thousands of hectares of landscape surrounding the park.

“Paddy fields” (Fig. 2E) are seasonally flooded rice fields adjacent to villages and degraded forest.

“Village habitat” (Fig. 2F) consists of human settlement areas embedded in the matrix of tea plantations, degraded forest, and fields. These areas include limited tree cover and several ponds.

Data collection. Field surveys were carried out in LNP and its adjacent areas from May 2011 to July 2017. Several survey methods were utilized to sample the herpetofauna.

(1) Dead-on-road (DOR) individuals were recorded during standardized road surveys. These specimens were collected along a 7 km segment of Srimangal-Bhanugach Road four to seven times a week from 11 July 2011 to 31 August 2012, totaling 2058 km over 294 survey days. This study method is described in detail in Rahman et al. (2013a). Road-killed individuals continued to be occasionally encountered through July 2017.

(2) Live and dead specimens were opportunistically collected. Some specimens were recorded by us while searching roads at night or while radiotracking pythons and tortoises for a separate study, but the main source of opportunistic specimens was through notifications from villagers. A member of the local field staff, Kanai Das, was designated as a community liaison and received calls from Fulbari Village residents to remove snakes from their premises. Less frequently we received calls from other villages.

(3) Specimens were recorded during visual-encounter surveys. In visual surveys, amphibians and reptiles were located via time-constrained searches on predetermined routes. From 14 May 2011 to 18 November 2011, regular visual surveys were conducted on five standardized routes totaling 1543 person-hours, described in detail in Rahman et al. (2013b). On 13–22 June 2014, 15 June–13 July 2015, and 15–24 July 2016 teams of herpetological surveyors conducted targeted nocturnal and diurnal visual surveys across a wider range of routes, with 82 separate surveys totaling 547 person-hours. Some team members focused their efforts on prime activity times for reptiles and amphibians in habitats which showed promise in revealing additional species, while other team members divided their effort systematically across all habitats and time periods. During the 2015 and 2016 surveys, audio encounter survey techniques (the observation of frog calls along a planned route) supplemented the visual surveys.

Locality and habitat data were recorded for every reptile and amphibian observation. In the standardized visual surveys, microhabitat and behavioral observations were recorded in field data sheets. Specimens not positively identified in the field were temporarily brought to an on-site lab to record morphometric data and photograph.

As LNP is a nationally protected area, it falls under the Wildlife (Conservation and Security) Act, 2012, which bans the removal and killing of wildlife. Thus, the collection of live specimens was not possible. Instead, diagnostic photographs were taken of significant spec-

imens and these were submitted to the Zoological Reference Collection of the Raffles Museum of Biodiversity Research. These photographic specimen vouchers are supplemented by a limited number of museum vouchers which had previously been collected by other researchers.

Abbreviations of museum collections are:

- CAS – California Academy of Sciences
- JUHG – Jahangirnagar University Herpetological Group
- ZRC(IMG) – Zoological Reference Collection, Raffles Museum of Biodiversity Research

Species accounts. Each species account includes material obtained and a description of identifying characteristics of the specimen. Color images are provided for selected specimens. Identification of specimens was based on regional field guides (Daniel 2002; Whitaker and Captain 2008; Khan et al. 2008; Ahmed et al. 2009; Kabir et al. 2009; Das 2010; Mathew 2010; Hasan MK et al. 2014), as well as original species descriptions and published keys, as cited. Justifications for taxonomy decisions are made within the accounts. Habitat preferences and notable life history information revealed during the survey are also provided.

Abbreviations of field collector names include:

- AG – Animesh Ghose
- JH – Jonathan Hakim
- KD – Kanai Das
- SCR – Shahriar Caesar Rahman
- ST – Scott J. Trageser

Results

Anura

Megophryidae

Leptobrachium smithi Matsui et al., 1999

Figure 3A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Lawachara Station; 24°19.49'N, 091°47.25'E; 5 Jul. 2015; photo voucher ZRC(IMG) 1.140.

Identification. This frog keys out to the *L. smithi* species complex due to its slender limbs, broad depressed head, and bicolored black/scarlet eyes (Kabir et al. 2009). It was distinguished from its closest congener *L. rakhi-nensis* Wogan, 2012 by having dark dorsal blotches not outlined in white, black mottling on the venter, distinct leg stripes, large sexual dimorphism, and bicolored eggs (Wogan 2012; Dutta et al. 2013). The calls were a unique duck-like “quack.”

Habitat. This species was common in forest habitat, typically found sitting on leaf litter at trail and road margins. It was observed calling and breeding in small streams. While it was most often seen in mature forest,



Figure 3. Some frogs of Lawachara National Park. **A.** *Leptobrachium smithi* (ZRC(IMG) 1.140). **B.** *Microhyla berdmorei* (ZRC(IMG) 1.141). **C.** *Microhyla mymensinghensis* (ZRC(IMG) 1.143). **D.** *Micryletta aishani* (ZRC(IMG) 1.144).

specimens were occasionally encountered in adjacent degraded forest.

Microhylidae

Kaloula pulchra Gray, 1831

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Lawachara Station; 24°19.49'N, 091°47.41'E; 16 Jul. 2016; photo voucher ZRC(IMG) 1.139.

Identification. This round, stocky frog was easily identified due to its blunt head, chocolate-brown dorsum, and broad tan dorsolateral stripes (Kabir et al. 2009). Its calls were a bull-like bellow.

Habitat. During and after storms calls could be heard from artificial ponds, flooded fields, and stagnant pools in streams, in both mature and degraded forest as well as tea plantation. Otherwise this species was usually found near human dwellings by turning over artificial cover.

Remarks. JH and ST observed an adult climbing a vertical tree trunk to a height of 5 m during a humid night on 24 June 2015.

Microhyla berdmorei (Blyth, 1856)

Figure 3B

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Lawachara Station; 24°18.91'N, 091°46.69'E; 17 Jun. 2015; photo voucher ZRC(IMG) 1.141.

Identification. *Microhyla berdmorei* in LNP was distinguished from other regional microhylids by its fully webbed toes and a tibio-tarsal articulation that extends beyond the tip of the snout (Kabir et al. 2009). Its dorsal color was variable, brown to reddish brown to light tan with markings ranging from dark black to gray to an indistinct tan, with or without gray borders. The specimens found in LNP were small in comparison to SE Asian populations, with SVL of 22.2–29.1 mm, but this is comparable to specimens from Northeast India (Garg et al. 2019).

Taxonomic remarks. Mahony and Reza (2008) and Hasan M et al. (2012) reported that *M. cf. berdmorei* in Bangladesh represents an undescribed species, but Garg et al. (2019) found populations throughout Northeast India and near our study site that conform genetically to known *M. berdmorei*.

Habitat. This species was found on trails, roads, and leaf litter in mature forest, degraded forest, tea plantation, and village habitat.

Microhyla mymensinghensis Hasan et al., 2014

Figure 3C

Material examined. BANGLADESH • 1 M, 19.2 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Lawachara Station; 24°19.58'N, 091°47.04'E; 16 Jun. 2015; 20:18; photo voucher ZRC(IMG) 1.142. • 1 F, 23.0 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, HEED guesthouse

near LNP; 24°20.32'N, 091°49.44'E; 16 Jun. 2015; 22:50; photo voucher ZRC(IMG) 1.143.

Identification. This microhylid was diagnosed as typical of the *M. ornata* complex with a triangular body, no visible tympanum, tan dorsum with dark X-shaped mark, and a dark lateral line (Kabir et al. 2009). Calls were a short, high-pitched “screech.” Our specimens agreed with the morphological characteristics for *M. mymensinghensis* described in Hasan M et al. (2014) and Poyarkov et al. (2014) in that they had a distinct outer tarsal tubercle and relatively long hind limbs (tibio-tarsal articulation varied from the eye to between the eye and snout). However, their large SVL (19.2–22.2 mm in males, 23.0–24.1 mm in females) was above the range described by Hasan (14.2–17.6 mm in males and 15.2–21.3 mm in females).

Taxonomic notes. Hasan M et al. (2014) demonstrated with mitochondrial DNA that frogs from this complex in central and northeast Bangladesh are *M. mymensinghensis*. Garg et al. (2019) reported from more extensive genetic testing that the range of *M. mymensinghensis* fully envelops our study site with no other species in close proximity, and in their examination of field specimens they also found that morphological characteristics overlap between species and are inconsistent with the descriptions in Hasan M et al. (2014).

Habitat. *Microhyla mymensinghensis* was widespread in the park, found in all habitats. It appeared on the surface less often than *M. berdmorei* and could instead be uncovered by raking leaf litter.

Remarks. JH observed 7–10 of these frogs calling around a rain puddle in mature forest on 28 Jun. 2015. JH observed numerous males making an impressive din around a flooded fallow paddy field after a storm on 8 July 2015.

Micryletta aishani Das et al., 2019

Figure 3D

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, north of Lawachara Station; 24°19.78'N, 091°47.15'E; 14 Jun. 2014; photo voucher ZRC(IMG) 1.144.

Identification. This small frog matched the description of *M. aishani* in having webbing-free toes, visible tympanum, dorsal skin shagreened with minute spinules, brown dorsal coloration with faint median band, scattered black spots towards posterior, black lateral streak from nose to vent, and ash-gray mottling on lips, flanks, and limb margins (Das et al. 2019).

Taxonomic notes. This account represents the first confirmed occurrence of *M. aishani* in Bangladesh. Das et al. (2019) found the species in three adjacent states of Northeast India, our finding being approximately 120 km southwest of the closest locality in Subhong, Assam, and 125 km north-northeast of the locality in Belonia, Tripura. This species has previously been misidentified as *Microhyla rubra* (Jerdon, 1853) in LNP and other

localities in Bangladesh (such as in Hasan MK et al. 2014), although the presence of *Micryletta* in Bangladesh was noted in Khan (2014). We have also seen specimens of *Microhyla berdmorei* and *Microhyla ornata* complex misidentified as *Microhyla rubra* (Khan 2008; Kabir et al. 2009), and are aware of no evidence that *Microhyla rubra* is found in Bangladesh despite its presence in lists and field guides.

Habitat. *Micryletta aishani* was almost always encountered within mature forest. All three sightings outside of that area were in village habitat.

Remarks. Within LNP, *M. aishani* was observed less often than other microhylids. On rare occasions in the rainy season it appeared in large numbers on a single stretch of road in mature forest. JH encountered at least 15 live specimens and ~100 road-killed specimens during a short walk of this stretch after a storm on 19 June 2014.

Dicroglossidae

Euphlyctis cyanophlyctis (Schneider, 1799)

Material examined. BANGLADESH • 1 F, 56 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, stream at Lawachara Station; 24°19.59'N, 091°47.10'E; 16 Jun. 2015; 20:39; photo voucher ZRC(IMG) 1.126.

Identification. Specimens observed in the park were tan to olive-brown frogs, often with large olive spots on the dorsum, which have eyes prominently placed towards the top of the head (Kabir et al. 2009). Calls among our specimens were 0.6–1.2 seconds long and made once every 2.0–2.5 seconds, pulsing at 13–16 pulses/s with a dominant frequency of 3100–3400 Hz and a fundamental around 1600–1700 Hz. Examined specimens keyed out to *E. cyanophlyctis* as opposed to the original description of *E. kalasgramensis* Howlader 2015 due to a large SVL of 49–56 mm in females, nostril-snout length 6–7% of SVL, nostril no closer to snout tip than eye, and first finger longer than both second and fourth.

Taxonomic notes. Howlader et al. (2015) described the congener *E. kalasgramensis* and showed genetic and/or morphological matches occurring to the north, west, and south of LNP. Surprisingly, our specimens aligned morphologically with Howlader et al.’s (2015) description of *E. cyanophlyctis* as opposed to *E. kalasgramensis*. However, the morphological description in Howlader’s paper was based on relatively few sites, and it is possible that the morphological characteristics will not hold with broader sampling. It is recommended that more sampling be done in this area to robustly distinguish these species across their wider range.

Habitat. One of the most widespread species in the park, *E. cyanophlyctis* was found in every type of mature and degraded habitat from dense forest to open fields. It usually sat or floated in still or slow-moving water bodies including man-made ponds, ditches, rice paddies, flooded fields, pools in drying streams, and slow-moving stream waters.

***Minervarya pierrei* (Dubois, 1975)**

Figure 4A

Material examined. BANGLADESH • 1 M, 32 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, north of Lawachara Station; 24°19.67'N, 091°47.10'E; 15 Jun. 2015; 18:45; photo voucher ZRC (IMG) 1.131. • 1 F, 41 mm adult; same collection data as for proceeding; photo voucher ZRC(IMG) 1.132.

Identification. This was a light-brown frog with dark dorsal markings and dorsum with (female specimen) or without (male specimen) a thin orange stripe. Snout-to-vent length was 41 mm in the examined female and 32 mm in the examined male, body tubercles were oblong and partially in rows, finger formula was $2=4<1<3$, and throat coloration in the male was dark on the sides but pale in the middle. These characteristics match published descriptions of *M. pierrei* (Rasel et al. 2007; Howlader 2011; Purkayastha and Matsui 2012).

Taxonomic notes. Recent studies have found that medium-sized *Minervarya* sampled from Bangladesh, including nearby Mymensingh District, were separate enough from other *Minervarya* spp. to potentially be considered an undescribed species (Islam et al. 2008; Hasan M et al. 2012). Chandramouli et al. (2019) found that many medium-sized *Minervarya* across South Asia, including *M. pierrei*, group inconsistently with their assigned taxon when tested genetically, suggesting either frequent misidentification of collection specimens or the need for several species to be redefined.

Habitat. The individuals described here were found breeding in a temporary rain puddle in a clearing in mature forest, and female *Minervarya* of similar size were found in mature and disturbed forest elsewhere in the park.

***Fejervarya orissaensis* (Dutta, 1997)**

Figure 4B

Material examined. BANGLADESH • 1 F, 56 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, main road at Fulbari Village; 24°20.09'N, 091°48.66'E; 17 Jun. 2015; 19:30; photo voucher ZRC(IMG) 1.133. • 1 M, 50 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, dirt road to Fulbari Village; 24°20.01'N, 091°48.91'E; 23 Jun. 2015; 20:48; photo voucher ZRC(IMG) 1.134. • 1 M, 46.8 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, fields behind HEED Guesthouse near LNP; 24°20.39'N, 091°49.47'E; 09 Jul. 2015; 00:32; photo voucher ZRC(IMG) 1.135.

Identification. Our specimens were grayish-brown and green frogs with a prominent pointed snout, dark dorsal markings, a broad cream or green middorsal stripe (some with thin or no stripe), SVL of 46.8–50.0 mm in sampled males and 56.0–58.9 mm in sampled females, finger formula of $2=4<1<3$ with 1 much longer than 2 and 4, oblong body tubercles arranged in rows, and W-shaped gular pattern in the males. This agrees with the Köhler et al. (2019) description of *F. orissaensis* in terms of dorsal



Figure 4. Some frogs of Lawachara National Park. **A.** *Minervarya pierrei* (ZRC(IMG) 1.131). **B.** *Fejervarya orissaensis* (ZRC(IMG) 1.133). **C.** *Hoplobatrachus tigerinus* (ZRC(IMG) 1.136). **D.** *Clinotarsus alticola*.

coloration, tubercles, male and female SVL, and finger formula, though the gular pattern differs somewhat (butterfly-shaped in *F. orissaensis* versus W-shaped in our specimens). One LNP male's call was recorded, a short (110–120 ms) croak repeated inconsistently with internote intervals of 270–540 ms at a dominant frequency of 3100–3300 Hz and a fundamental frequency of 2100–2200 Hz. This call is similar in type and length to the call of *F. orissaensis* in Myanmar as reported in Köhler but differs significantly in pulse rate, internote interval, and dominant frequency.

Taxonomic notes. The previous umbrella term of *F. limnocharis* (Gravenhorst, 1829) that was once attributed to Lawachara specimens is now considered to only be valid for the type species occurring in Sundaland (Veith et al. 2001). Large-size *Fejervarya* from Bangladesh, including LNP (Rahman and Howlader 2011a), have more recently been designated as *F. teraiensis* (Dubois, 1984), and indeed our morphological characterization agrees with published descriptions of this species (Rasel et al. 2007; Howlader 2011; Purkayastha and Matsui 2012), though the calls differ to some degree. However, genetic studies previously suggested that the “large type” *Fejervarya* in Bangladesh, including in the Sylhet Division, do not align with *F. teraiensis* (Islam et al. 2008; Kotaki et al. 2010; Hasan M et al. 2012; Sanchez et al. 2018). Köhler et al. (2019) found genetic samples from Bangladesh to align with *F. orissaensis* and formally attributed the large-type *Fejervarya* of Bangladesh to this species. More sampling will need to be done to accurately describe *F. orissaensis* across their entire range.

Habitat. *Fejervarya orissaensis* in LNP were found in heavily disturbed areas such as paddy fields and village habitat.

***Hoplobatrachus tigerinus* (Daudin, 1802)**

Figure 4C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, field behind HEED Guesthouse near LNP; 24°19.86'N, 091°47.64'E; 4 Jun. 2016; photo voucher ZRC(IMG) 1.136.

Identification. This frog fit the description of *H. tigerinus* as a large brown and olive frog with dark blotches and light dorsal line, pointed snout, tympanum and supratympanic fold prominent, and legs large and powerful (Kabir et al. 2009). It was distinguished from the similar *H. crassus* (Jerdon, 1854) by a more pointed snout, tibio-tarsal articulation which extends past the eye, and SVL of over 13 cm in adults (Khan 2008). It was distinguished from *H. litoralis* Hasan et al., 2012 due to the lack of distinctness of the black bands across the eye and both lips (Hasan MK et al. 2012). Its call is a loud and deep croak repeated at regular intervals.

Habitat. *Hoplobatrachus tigerinus* was predominantly found in heavily human-modified areas such as rice paddies, canals, and man-made ponds. Adults were always

found near water, while juveniles could be found some distance away even in degraded forest and tea plantation.

Ranidae

***Clinotarsus alticola* (Boulenger, 1882)**

Figure 4D

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, stream near Lawachara Station; 24°19.56'N, 091°47.15'E; 16 Jun. 2014; 20:38; photo voucher ZRC(IMG) 1.124.

Identification. This frog was verified as *C. alticola* due to yellow to brown coloration with a long, pointed head and slender legs (Kabir et al. 2009) and by calls including a variety of squeaks and trills. Typical squeak was 45–70 ms with a dominant frequency that started from 2000–3000 Hz and dropped to under 1000 Hz along with another frequency band that started at 3500 Hz and dropped to near 1000 Hz. A different call lasted 300 ms with frequency bands that started at 1200 Hz and 1800 Hz and then rose to 1600 Hz and 2300 Hz. There was also a low-frequency trill which lasted about 230–500 ms, composed of 5–18 pulses of only 10–20 ms each, each pulse starting at about 2500–3000 Hz and dropping to 1000–2000 Hz. Other trills of similar length had 30 ms pulses with a consistent 2300 Hz frequency.

Habitat. *Clinotarsus alticola* was found calling on streambanks throughout mature forest and on occasion in degraded forest. Otherwise it was found sitting at the edge of forest trails.

***Hydrophylax leptoglossa* (Cope, 1868)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, pond near Lawachara Station; 24°19.58'N, 091°47.04'E; 14 Jun. 2014; 20:38; photo voucher ZRC(IMG) 1.137.

Identification. A brown (rarely green) frog with mottled black flanks and a thick dorsolateral fold which is the same color as the dorsum. It can be distinguished from the similar *Sylvirana nigrovittata* (Blyth, 1856) by a more distinct dorsolateral fold and the established species range (Hasan et al. 2011), and from *Hylarana tytleri* by being broader in head and body, darker in color, and lacking the white-gold coloration of the dorsolateral fold (Kabir et al. 2009). Calls were 0.8–1.4 seconds long with a pulse rate of 8–9 pulses/s with pulses which distinctly alternated in amplitude. Dominant frequency of the calls peaked at 2400–2800 Hz with a fundamental around 600–700 Hz.

Habitat. This species was most often associated with streams and puddles in dried stream beds within mature forest. It was also found in streams in tea plantation and degraded forest and in paddy fields.

***Hylarana tytleri* (Theobald, 1868)**

Material examined. BANGLADESH • 1 M, adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila,

LNP, pond behind Nishorgo Dormitory; 24°20.07'N, 091°49.12'E; 4 Jun. 2016; 19:37; photo voucher ZRC(IMG) 1.138.

Identification. This frog was identified as *H. tytleri* due to its small size, slender golden-colored body with white-gold dorsolateral fold, and lack of a middorsal stripe (Kabir et al. 2009). The identification was confirmed by Stephen Mahony (pers. comm.).

Taxonomic notes. Hasan et al. (2019) found strong genetic uniformity of *H. tytleri* from seven sites across Bangladesh, addressing previous questions regarding its status, and found that previous records of the East Asian *H. taipehensis* (Van Denburgh, 1909) in Bangladesh represented misidentifications. This account represents the first confirmed record for *H. tytleri* in Sylhet Division, 145 km east-southeast of the closest recorded locality in Bangladesh at Bangladesh Agriculture University College, Mymensingh (Rana and Musa 2016; Hasan et al. 2019).

Habitat. *Hylarana tytleri* was only observed on two occasions by us, both times near artificial ponds at the edge of village habitat.

Rhacophoridae

Chirixalus doriae (Boulenger, 1893)

Figure 5A

Material examined. BANGLADESH • 1 F, 30 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, road near Chevron complex; 24°19.88'N, 091°47.63'E; 23 Jun. 2015; 23:45; photo voucher ZRC(IMG) 1.153. • 2 M, 28.3 mm and 28.8 mm adults; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, field behind HEED Guesthouse; 24°20.38'N, 091°49.45'E; 10 Jul. 2015; 20:00; photo voucher ZRC(IMG) 1.152a-b.

Identification. As small tan treefrogs with no distinct dorsolateral stripe and several dark dorsal stripes, our specimens keyed out ambiguously between *C. simus* (Annandale, 1915) and *C. doriae* in Wilkinson et al.'s (2003) key. The key's distinguishing characteristics of snout pointedness, skin smoothness, and presence of glandular fold were inconsistent in our specimens and may not be adequate in delineating these two species, potentially leading to misidentifications (Stephen Mahony pers. comm.). Instead, we focused on SVL, which varied from 26–28.8 mm in males and 30–34.2 mm in females, thus aligning the specimens with *C. doriae* as opposed to the much smaller *C. simus* (Deuti et al. 2000; Aowphol et al. 2013; Stephen Mahony pers. comm.). The call consisted of short trills of 130–300 ms with a pulse rate of 23–31 pulses/s at a dominant frequency of 3900–4100 Hz and a fundamental at 1400–1700 Hz. This call type, length, and dominant frequency closely match what was reported for *C. doriae* in Thailand in Aowphol et al. (2013), though the pulse rate recorded in LNP was about 50% higher than for Thai specimens, potentially

due to differences in temperature while calling.

Taxonomic notes. *Chirixalus doriae* had previously been confirmed in LNP (as *Chiromantis doriae*) by Hasan et al. (2010). The presence of *C. simus* in LNP was published by Rahman and Howlader (2011b). However, we now believe that this was the result of a misidentified *C. doriae* for the reasons mentioned above. There is also a specimen deposited as *Chiromantis simus* in the JUHG collection, but access to the specimen has been denied. We suspect that it may also be a misidentified *C. doriae*. Banerjee (2010) found *C. simus* in Kolkata to have a call frequency of 3300 Hz, 600–800 Hz lower than that of our specimens.

Habitat. During the breeding season *C. doriae* was found calling near permanent and temporary ponds in mature forest, flooded roadside vegetation in degraded forest and tea plantation, and in paddy fields. However, it was not found to call from streams, even where the streams had dried to form pond-like puddles. Males of this species called from vegetation 20–150 cm high. On 10 July 2015, JH observed several recently formed egg masses covered in foam at a height of 40–50 cm in bushes at the edge of a flooded field.

Feihyla hansenae (Cochran, 1927)

Figure 5B

Material examined. BANGLADESH • 1, 25 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, pond near Lawachara Station; 24°19.58'N, 091°47.04'E; 17 Jun. 2015; 20:26; photo voucher ZRC(IMG) 1.127.

Identification. This is a tan-to-yellowish treefrog with pale dorsolateral stripe (which often fades during daylight hours), no dark spots on the dorsum, and an indistinct tympanum, thus keying out to *Chiromantis vittatus* (Boulenger, 1887) (now *F. vittata*) as defined by Wilkinson et al. (2003). It failed to key out to *F. hansenae* because the tympanum was not distinct, though Wilkinson et al. (2003) noted that the distinct tympanum was not a consistent feature and considered *F. hansenae* to be a possible junior synonym of *F. vittata*. Aowphol et al. (2013) showed that *F. hansenae* and *F. vittata* in Thailand had clear genetic separation and were distinguishable on account of their distinct calls. We repeatedly observed males making a single-note “peep” call of 20–30 ms with a dominant frequency of 4300–4600 Hz. These calls align the specimens with *F. hansenae* and are nothing like the 500+ ms trills reported for *F. vittata*. This identification of our specimens as *F. hansenae* based on both appearance and calls was confirmed by Attapol Rujirawan (pers. comm.) and the identification of the calls was further confirmed by Sinlan Poo (pers. comm.).

Taxonomic notes. This new identification represents a country record for the species in Bangladesh and a range extension of 850 km northwest from the closest known locality of Mae Hong Son, Thailand (Yodthong et al.



Figure 5. Some frogs of Lawachara National Park. **A.** *Chirixalus doriae*. **B.** *Feihyla hansenae*. **C.** *Rhacophorus bipunctatus* (ZRC(IMG) 1.147). **D.** *Theloderma baibungense*.

2014). Attapol Rujirawan (pers. comm.) suggests that previous misidentifications were likely commonplace and that the range of *F. hansenae* could be far larger than is currently known. Khan's (2008) report of *F. vittata* from Bangladesh described a call which matches that of *F. hansenae* as reported here, suggesting that this misidentification may occur across the country. The presence of *F. vittata* in LNP (as *C. vittatus*) was published in Kabir et al. (2010), but we now believe that this is a misidentification of *F. hansenae* for the reasons described above.

Habitat. These frogs were encountered in both permanent and temporary ponds in mature forest, disturbed forest, and village habitat. Males were found calling from leaves anywhere from 20 cm to 2 m above the surface of the water, sometimes hanging on the underside of a leaf.

***Polypedates teraiensis* (Dubois, 1987)**

Material examined. BANGLADESH • 1 M, 46 mm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, pond near Lawachara Station; 24° 19.58'N, 091°47.04'E; 16 Jun. 2015; 20:20; photo voucher ZRC(IMG) 1.145.

Identification. A large brown treefrog (9 cm SVL in our largest female specimen) with dark lines on the dorsum and a light brown eyestripe that curves down. Specimens were distinguished from *P. maculatus* (J.E. Gray, 1830) by skin ossified to the top of the skull (Ahmed et

al. 2009). Calling males most frequently gave a short 140–280 ms “quack” with 65–85 pulses/s and a dominant frequency at 2000–2400 Hz; other calls were reminiscent of laughter.

Taxonomic notes. Gogol and Sengupta (2017) confirmed that *P. teraiensis* in South Asia is distinct from *P. leucomystax* (Gravenhorst, 1829) in Southeast Asia, though Purkayastha et al. (2019) suggests that the status of *P. leucomystax* in the region remains undetermined, so we follow Gogol and Sengupta with caution.

Habitat. *Polypedates teraiensis* was common in every habitat in LNP. The frogs were observed calling and breeding in ponds, temporary pools formed by dried-up streams, flooded fields, and flooded forest. While occasionally found on the ground, most individuals were found at heights of 1–2 m in trees.

***Raorchestes rezakhani* Al-Razi et al., 2020**

Material examined. BANGLADESH • 1 M, adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail northeast of Lawachara Station; 24°19.87'N, 091°47.30'E; 06 Jul. 2015; 23:54; photo voucher ZRC (IMG) 1.146.

Identification. This frog was a small, stocky brown male specimen with slightly webbed feet and toe pads. It had a dark brown “Y” mark between its eyes and an “inverted parentheses” dorsal marking on its body. The call was cricket-like with somewhat more tone, “tik-tik-tik-tik...tik-tik-tik-tik.” Morphology was similar to that

of *Raorchestes* species found in Northeast India, but delineation to species level is only possible with genetic data (Franky Bossuyt pers. comm.; Stephen Mahony pers. comm.). Other researchers collected genetic samples from two male *Raorchestes* frogs in LNP and found them to represent a novel species, *R. rezakhani* (Al-Razi et al. 2020).

Habitat. *Raorchestes rezakhani* was encountered once, by JH in the middle of a prime section of mature forest. A male was calling from a leaf at night a few hours after a light rain. Other researchers observed two additional male frogs in undergrowth 2.0 km away in similar mature forest habitat.

Rhacophorus bipunctatus (Ahl, 1927)

Figure 5C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail west of visitor center; 24°18.52'N, 091°46.47'E; 24 Jun. 2015; 21:26; photo voucher ZRC(IMG) 1.147.

Identification. *Rhacophorus bipunctatus* is a medium-sized treefrog distinguished from other *Rhacophorus* species by its green coloration, webbed front feet, orange toe/finger webbing without black spots, and two ink-black spots on the flanks (Bordoloi et al. 2007). The primary call was an insect-like run of 200–700 ms with distinct 8–10 ms pulses at 16–17 pulses/s and dominant frequency of 1800–2200 Hz. It was also heard to make a *Polypedates*-like “quack” at times, a 110–150 ms call with a pulse rate of 40–50 pulses/s and frequency peak at 2200–2500 Hz. We follow Bordoloi et al. (2007) in considering *R. htunwini* to be a junior synonym of *R. bipunctatus*.

Taxonomic notes. *Rhacophorus bipunctatus* is morphologically similar to *R. rhodopus* Liu & Hu, 1960, and more work is necessary to sufficiently describe and separate these species, but currently there is no evidence that *R. rhodopus* is found in south Asia (Chan Kin Onn pers. comm.).

Habitat. This treefrog was only found in mature forest, especially where large trees were most dense.

Theloderma baibungense (Jiang et al., 2009)

Figure 5D

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail near Lawachara Station; 24°19.79'N, 091°47.19'E; 18 Jun. 2014; 21:26; photo voucher ZRC(IMG) 1.148.

Identification. This treefrog is easily differentiated from other regional frogs by its characteristic brown, tan, and white mottled coloration, reminiscent of tree fungus or bird droppings (Ahmed et al. 2009). With its webbed toes, reddish eyes, cream-colored body with distinct brown markings on the top of head and back, dark brown legs with black and cream banding, and dark marbling on venter, the frogs appear morphologically identical to *T. pyaukkya* Dever, 2017 in Myanmar, which is

now being subsumed under *T. baibungense* (Dever 2017, Poyarkov et al. 2018; Nikolay Poyarkov pers. comm.).

Taxonomic notes. Though south Asian frogs of this species complex were previously identified as *T. asperum* (Boulenger, 1886) or *T. albopunctatus* (Liu and Hu, 1962), genetic evidence has shown that Northeast Indian and central/northern Burmese members of the group are *T. baibungense* (Hou et al. 2017; Poyarkov et al. 2018; Nikolay Poyarkov pers. comm.). The first researcher to find *Theloderma* in Bangladesh was the late Tania Khan, who discovered it in LNP in 2012. Her find was 55 km west of the nearest previously reported locality in Dosdewa Khasi Village, Assam, India (GBIF 2020, as *T. asperum*).

Habitat. All four live specimens were perched on broad-leaf plants 0.5–1.0 m above the ground in mature forest. This frog may be more common than these rare sightings indicate, but rarely encountered due to cryptic nature and arboreal microhabitat.

Bufonidae

Duttaphrynus melanostictus (Schneider, 1799)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, HEED Guesthouse near LNP; 24°19.89'N, 091°47.64'E; 18 Jun. 2015; photo voucher ZRC(IMG) 1.125.

Identification. The only toad in the park, *D. melanostictus*, is identified by its large parotoid glands, black-tipped “warts”, and strong black cranial ridges (Ahmed et al. 2009).

Habitat. *Duttaphrynus melanostictus* was found throughout the park in mature and disturbed forest, tea plantation, and village habitat. It was under logs, concrete, and other artificial cover during the day and on trails or near buildings at night.

Gymnophiona

Caeciliidae

Chikila fulleri (Alcock, 1904)

Material examined. BANGLADESH • 1; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail near visitor center; 24°18.8'N, 091°46.5'E; 26 Sep. 2012; photo voucher ZRC(IMG) 1.123.

Identification. These specimens were identified as *C. fulleri* due to dark purplish-gray dorsal color, only moderately bicolored body, strongly marked annular grooves, moderately pointed head, and substantial pale patches on the throat (Kamei et al. 2013).

Taxonomic notes. Tania Khan and Reza Khan collected one dead and three live specimens in LNP in 2012 and determined them to be *C. fulleri* through laboratory study (Tania Khan pers. comm.). This record represents the first Gymnophiona recorded in Bangladesh, 60 km northwest of the nearest previously published occurrence of *C. fulleri* in Vanghmun, Tripura (Kamei et al. 2013).

Habitat. All five specimens (including an additional dead specimen found by us) were found in mature forest. Live specimens found by Tania Khan and Reza Khan were uncovered by digging in the forest floor (Daily Star 2012).

Remarks. On 18 June 2015 JH retrieved a dead caecilian from a sandy stream bottom fitting the description of *Chikila*. The carcass was being devoured by a crab and two crayfish, and the head and tail were both missing. Even incomplete it was 28 cm long, longer than any known specimen of this genus (Kamei et al. 2013).

Chelonii
Geoemydidae

Cyclemys gemeli Fritz et al., 2008

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, sandy streambed near visitor center; 24°19.19'N, 091°46.88'E; 13 May 2013; photo voucher ZRC(IMG) 2.396a-b.

Identification. This turtle was identified to the *Cyclemys* genus based on a rounded shell with a keel down the middle of the carapace and serrated posterior marginals which flatten to the side (Ahmed et al. 2009). Turtles observed had shell color from brown to washed-out gray and a uniform tan skin color with slight dark lines. The front of the head slopes upwards, coming to a point just above the nostrils and level with the flat top of the head. *Cyclemys* in Bangladesh are currently considered to belong to *C. gemeli* and thus we have assigned it to that taxa, but the genus is in flux and according to IUCN Bangladesh (2015) the status of this species in Bangladesh may change in the future.

Habitat. All occurrences were on sandy streambeds in mature forest.

Remarks. Our sightings were limited to one hatchling brought to project staff by local villagers in August 2012 and an adult found by AG on 13 May 2013. In July 2017, ST identified *Cyclemys* tracks on a streambed. Two more recent sightings of live specimens have been made by other researchers (Hassan Al-Razi pers. comm.).

Testudinidae

Indotestudo elongata (Blyth, 1854)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Baghmara village; 24°20.56'N, 091°48.64'E; 18 Jun. 2015; photo voucher ZRC(IMG) 2.359.

Identification. Unique in the region, *I. elongata* is a yellowish-brown tortoise of moderate size (our specimens up to 33 cm long) with a domed carapace and pinkish-red markings on the face during breeding season (Ihlow et al. 2016).

Habitat. Radio-tracked tortoises were found to utilize both mature and degraded forest.

Remarks. Sightings of this species were rare in LNP due to pressure from local hunters for domestic consumption. Villagers in LNP told us that in the 1990s hunters could find seven or eight of these tortoises in a single day, while now they go months without seeing one. Due to an educational outreach project undertaken by the Creative Conservation Alliance, two tortoises were brought to our staff by villagers. These then had radio-transmitters affixed to their shells and were released back into the wild and tracked for the next year. Eight non-resident tortoises, rescued from hunters in Bandarban District, were also affixed with transmitters and released into LNP as a pilot relocation study. Additional data from these radio-tracking studies will be published in an upcoming paper.

Squamata
Gekkonidae

Cyrtodactylus tripuraensis Agarwal, 2018

Figure 6A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail near visitor center; 24°18.73'N, 091°46.75'E; 21 Jun. 2015; 22:56; photo voucher ZRC(IMG) 2.348. • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail near visitor center; 24°18.79'N, 091°46.73'E; 4 Jul. 2015; 20:53; photo voucher ZRC(IMG) 2.349. • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Lawachara Station; 24°19.79'N, 091°47.18'E; 19 Jun. 2014; photo voucher ZRC(IMG) 2.350. • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Lawachara Station; 24°19.79'N, 091°47.03'E; 19 Jun. 2014; photo voucher ZRC(IMG) 2.351.

Identification. Our specimens of this ground-dwelling gecko could be distinguished from most other members of the genus by a dorsal pattern of 9–10 paired dark rectangular markings bordered on posterior by light bands, light bands on tail much narrower than dark blotches, greenish-gold iris, 32–34 ventral scale rows, six widened subdigital lamellae, a single pair of postmentals in broad contact, no precloacal groove, and presence in lowland habitat (Bauer 2003). Female geckos recorded at our site had 18–26 precloacal-femoral pores, aligning them with *C. tripuraensis* as opposed to *C. ayeyarwadyensis* Bauer, 2003 according to Agarwal et al.'s (2018) key (19–29 precloacal-femoral pores for *C. tripuraensis* females, precloacal-femoral pores absent in *C. ayeyarwadyensis* females).

Taxonomic notes. Al-Razi et al. (2018) were the first to confirm *C. tripuraensis* in Bangladesh. They found 34 precloacal-femoral pores in a male specimen from LNP, within the range of 29–37 precloacal-femoral pores in male *C. tripuraensis* as opposed to 10–28 in *C. ayeyarwadyensis*. The LNP locality was 40 km northwest of the closest previously known record in Tripura, India.

Habitat. This gecko was primarily observed in mature



Figure 6. Some lizards of Lawachara National Park. **A.** *Cyrtodactylus tripuraensis* (ZRC(IMG) 2.349). **B.** *Riopa albopunctata* (ZRC(IMG) 2.363). **C.** *Sphenomorphus maculatus* (ZRC(IMG) 2.376). **D.** *Takydromus* sp. (ZRC(IMG) 2.377).

forest, though JH found one specimen under a log in tea plantation. During the day it was found under logs and buried in leaf litter, often on side-hills, while at night it could be seen crawling across dirt and leaf litter, on top of logs, and on vegetation to a height of about 1 m. Unlike most other *Cyrtodactylus* but similarly to its closest relative *C. ayeyarwadyensis* (Agarwal 2014), *C. tripuraensis* in LNP does not rely on rocky habitats.

Gekko gekko (Linnaeus, 1758)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Wildlife Rescue and Rehabilitation Center at Janki Chora; 24°18.72'N, 091°46.52'E; 13 Jul. 2013; photo voucher ZRC(IMG) 2.356.

Identification. This gecko is easily identified by its large size, large head, and brilliant red and bluish-gray color with a banded tail (Das 2010).

Habitat. *Gekko gekko* was found in every habitat in LNP where trees or buildings were present.

Hemidactylus frenatus Duméril & Bibron, 1836

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Wildlife Rescue and Rehabilitation Center at Janki Chora; 24°18.71'N, 091°46.51'E; 1 Aug. 2015; photo voucher ZRC(IMG) 2.357.

Identification. *Hemidactylus frenatus* is a brown-to-gray gecko with smooth dorsal scales and round tail bearing rings of enlarged tubercles (Das 2010).

Habitat. *Hemidactylus frenatus* was most often encountered on the walls of human habitations in village habitat. It was also found in tea plantation and in disturbed and mature forest, usually on vegetation 1–3 m above the ground.

Hemidactylus platyurus (Schneider, 1797)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Wildlife Rescue and Rehabilitation Center at Janki Chora; 24°18.72'N, 091°46.52'E; 5 Jul. 2015; photo voucher ZRC(IMG) 2.358.

Identification. *Hemidactylus platyurus* is a brown to gray gecko with smooth dorsal scales and flattened tail with serrated edges (Das 2010).

Habitat. This gecko was primarily encountered in mature forest, from dusk to night on tree trunks or fallen logs suspended above the ground, and occasionally in disturbed forest. This species was rarely found in village habitat and was generally only seen on buildings when they were surrounded by forest. While common in human habitat in many parts of its range, in LNP *H. platyurus* appears to be displaced there by *H. frenatus*.

Scincidae

***Eutropis macularia* (Blyth, 1853)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Wildlife Rescue and Rehabilitation Center at Janki Chora; 24°18.74'N, 091°46.52'E; 20 Jun. 2015; 13:53; photo voucher ZRC(IMG) 2.355.

Identification. We differentiated *E. macularia* in LNP from other *Eutropis* species by its dark flanks with clear white spotting, 7–10 keels on each dorsal scale, an adult SVL of 6–7 cm, and the presence of brilliant red breeding coloration in males (Das 2010).

Habitat. We found this skink in forest clearings, including small clear-cuts, along railroad lines, and in building projects in both mature and degraded forest as well as tea plantation.

***Eutropis multifasciata* (Kuhl, 1820)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, student dormitory; 24°20.16'N, 091°49.14'E; 22 Jun. 2015; 14:58; photo voucher ZRC(IMG) 2.397a-b.

Identification. This is a large skink identified by a heavy body with a SVL of approximately 10–12 cm, distinct lines on dorsal surface, three keels per scale on the dorsal scales, and a lack of prominent speckling on the lateral surface (Das 2010).

Habitat. This skink appeared limited to sunny areas in human-modified habitats, including cleared areas in tea plantation and disturbed forest as well as near villages and dormitories.

***Riopa albopunctata* Gray, 1846**

Figure 6B

Material examined. BANGLADESH • 1, 12.7 cm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Srimangal-Bhanugach Road bordering Fulbari Tea Estate; 24°19.78'N, 091°47.58'E; 15 Jun. 2015; 21:50; photo voucher ZRC(IMG) 2.363.

Identification. *Riopa albopunctata* is an extremely slender, small-limbed skink with a light brown dorsum bearing narrow, dark, broken lines and dark sides with white speckling but fading to brown towards tail. Hatchlings were a more uniformly deep brown with a maroon tail. This species is differentiated from other *Riopa* species by its pattern and gestalt, with the identification confirmed by Aniruddha Dutta and Stephen Mahony (pers. comm.).

Habitat. We rarely found this predominantly fossorial skink in LNP. One specimen was on a road at night near a tea plantation and three adults were found by turning concrete and wood near human habitations in village habitat.

Remarks. Under a large piece of concrete where an adult *R. albopunctata* (SVL 56 mm, TL 128 mm) had previously been spotted, three eggs with dimensions of $11.6 \times$

7.2 mm were found on 27 June 2015. The eggs lay on top of bare ground directly under the concrete. These eggs were kept in soil in a plastic jar and hatched on 5 July 2015; hatchlings had snout-vent length of 22.4–23.5 mm and total length of 46.4–48.0 mm.

***Sphenomorphus maculatus* (Blyth, 1853)**

Figure 6C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°20.98'N, 091°46.56'E; 15 Jun. 2015; 21:30; photo voucher ZRC(IMG) 2.376.

Identification. This is a medium-sized skink with bronze dorsum and dark flanks lightly speckled with white. It was distinguished from *Scincella* Mittleman, 1950 by the shape of the head and from *Sphenomorphus indicus* (Gray, 1853) by the concave rostral scale (Kabir et al. 2009; Stephen Mahony pers. comm.).

Taxonomic notes. Khan (2007) listed *Scincella reevesii* (Gray, 1838) as occurring in LNP, but we agree with Mahony et al. (2009) that this was a misidentification of a specimen of *S. maculatus* and that *S. reevesii* and *S. indicus* are yet to be verified in Bangladesh.

Habitat. This skink could be seen on the ground both day and night in all habitats except for rice paddy. It appeared to prefer leaf litter at habitat edges but has also been observed on bare ground and in dense forest.

Lacertidae

***Takydromus khasiensis* Boulenger, 1917**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Lawachara Forest; 24°20.47'N, 091°47.81'E; 27 Sep. 1961; CAS 94297. • 1; same collection data as for proceeding; CAS 94298. • 1; same collection data as for proceeding; CAS 94299.

Identification. Three *Takydromus* specimens collected in 1961 and preserved in the CAS were found to key out closest to *T. khasiensis*, with three chin shield pairs (though in one specimen one of the pairs was nearly split), 6–7 upper labials, SVL 3.3–3.4 times longer than head length, tail length 2.4 times longer than SVL, and color faded in preservation but showing a narrow dark band that fades around mid-body (Boulenger 1917; Arnold 1997). In the specimen record Indraneil Das formally identified these specimens (CAS 94297–94299) as *T. khasiensis*, the only *Takydromus* species confirmed from our region.

Remarks. Our group made two sightings of *Takydromus* in five years, both in mature forest. The first was an active individual within a manmade clearing while the second was an individual sleeping on a leaf 0.5 m above the ground under open canopy. However, the *Takydromus* specimen found in LNP by us (Fig. 6D) differed significantly from described *T. khasiensis* in scalation, morphology, and color pattern. Indraneil Das and Si-Min

Lin (pers. comm.) reviewed the photographs and scale counts and were of the opinion that our specimen represents a novel species. A definitive conclusion and description requires genetic sequencing of the population.

Agamidae

***Calotes emma* Gray, 1845**

Figure 7A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°18.63'N, 091°46.56'E; 5 Jul. 2015; 21:00; photo voucher ZRC(IMG) 2.345.

Identification. This *Calotes* species with vertically compressed body and a dorsal crest is distinguished from the similar *C. versicolor* by the presence of a large spine above the eye and a pronounced skin fold at the shoulder (Das 2010).

Habitat. *Calotes emma* is restricted to mature forest in LNP.

***Calotes versicolor* (Daudin, 1802)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°18.34'N, 091°46.61'E; 13 Jun. 2014; photo voucher ZRC(IMG) 2.346.

Identification. This typically tan agamid (some specimens yellowish or greenish) with vertically compressed body and dorsal crest was distinguished from the similar *C. emma* by the lack of a large spine above the eye (Das 2010).

Habitat. *Calotes versicolor* is a common but habitat-restricted lizard in LNP, found only where low vegetation occurs at sunny habitat edges. Within these constraints it was observed in mature and degraded forest, tea plantation, and village habitat. At night individuals were often found asleep on small branches 1–3 m above the ground.

***Ptyctolaemus gularis* (Peters, 1864)**

Figure 7B

Material examined. BANGLADESH • 1 adult; Sylhet



Figure 7. Some lizards of Lawachara National Park. **A.** *Calotes emma* (ZRC(IMG) 2.345). **B.** *Ptyctolaemus gularis* (ZRC(IMG) 2.372). **C.** *Varanus bengalensis*.

Division, Moulvibazar District, Kamalganj Upazila, LNP, stream near Lawachara Station; 24°19.81'N, 091°47.20'E; 19 Jun. 2015; 21:18; photo voucher ZRC(IMG) 2.372.

Identification. This is a slender grayish agamid with a nuchal fold; it is easily distinguished from other local agamids by the characteristic deep-blue gular sac and the absence of a dorsal crest (Kabir et al. 2009).

Habitat. This lizard was only found in mature forest.

Varanidae

Varanus bengalensis (Daudin, 1802)

Figure 7C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near Fulbari Village; 24°19.16'N, 091°48.23'E; Jul. 2011; photo voucher ZRC(IMG) 2.379.

Identification. A typical mid-sized monitor, *V. bengalensis* is distinguished from *V. flavescens* (Hardwicke & Gray, 1827) and *V. salvator* by its nostrils which are as close or closer to the eye than to the tip of the snout (Kabir et al. 2009).

Habitat. This monitor was seen climbing trees and hunting in stream beds in mature and degraded forest, swimming in paddy fields, and walking through tea plantation and village habitat.

Remarks. The flesh of this monitor was occasionally eaten by people in villages bordering LNP.

Varanus salvator (Laurenti, 1768)

Material examined. BANGLADESH • 1 subadult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, near western Chevron guard station; 24°20.03'N, 091°48.11'E; 16 Jun. 2014; 13:22; photo voucher ZRC(IMG) 2.226a-c.

Identification. The single *V. salvator* found in the park was a large monitor (~2 m) distinguished from *V. flavescens* and *V. bengalensis* by its larger size, relatively narrower head than *V. flavescens*, and more forward-oriented nostrils than *V. bengalensis* (Kabir et al. 2009).

Taxonomic notes. This record represents the only sighting of *V. salvator* in the park. It was published as a division record from Sylhet Division (Ghose et al. 2016).

Habitat. The record was made in disturbed forest.

Remarks. The individual reported here was pointed out to us by a local security guard, who found it dead on railway tracks with its head nearly severed by a train. The existence of only one record for a large, easily visible species like *V. salvator* is striking, and together with the fact that the specimen was discovered next to the railroad tracks has led us to consider whether the one occurrence may have been a human-aided translocation rather than evidence of a permanent population. However, *V. salvator* is highly mobile and has the potential to disperse widely, and it is possible that individuals of the species move in and out of the park boundaries on their own.

Typhlopidae

Argyrophis diardii (Schlegel, 1839)

Figure 8A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, stream near Lawachara Station; 24°20.11'N, 091°50.66'E; 8 Jul. 2015; 22:10; photo voucher ZRC(IMG) 2.339.

Identification. This dark brown blind snake is easily distinguished from other blind snakes by its much greater length and robustness, distinct eye, and ventral color only somewhat lighter than dorsal color with gradual transition (Das 2010).

Habitat. *Argyrophis diardii* was encountered across all habitat types in LNP, typically DOR. Surprisingly for a blind snake it was twice found active on the surface in dry weather, once in a tea plantation during the day (SCR) and once at a streambank in mature forest during an overcast night (ST).

Indotyphlops braminus (Daudin, 1803)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, HEED Guesthouse near LNP; 24°20.32'N, 091°49.44'E; 22 Jun. 2015; 10:30; photo voucher ZRC(IMG) 2.360.

Identification. *Indotyphlops braminus* is a slender black or brown blind snake identified in our region by 20 rows of midbody scales, relatively moderate girth, and absence of a pale or white head (Das 2010).

Taxonomic notes. Additional species of *Indotyphlops* are suspected to be present among the 126 blind snakes found in the roadkill survey and others in the field. These samples could not be identified to species due to extensive specimen damage and lack of microscopes on site during most of the project.

Habitat. During the roadkill survey, unidentified blind snakes were found throughout the park in every habitat other than paddy fields. Several blind snakes were also found live under concrete in village habitat in June and July 2015, and it was only these that were conclusively identified as *I. braminus* once resources had become available. It is likely that the specimens found in other non-aquatic habitats in the park were also *I. braminus*.

Pythonidae

Python bivittatus (Kuhl, 1820)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari Tea Estate; 24°20.06'N, 091°49.04'E; 10 Jun. 2016; photo voucher ZRC(IMG) 2.373.

Identification. This heavy-bodied python is distinguished from the other python in the region, *Malayopython reticulatus* (Schneider, 1801), by its larger girth, arrowhead-like marking on top of the head, and dorsal pattern of dark brown blotches (Kabir et al. 2009).

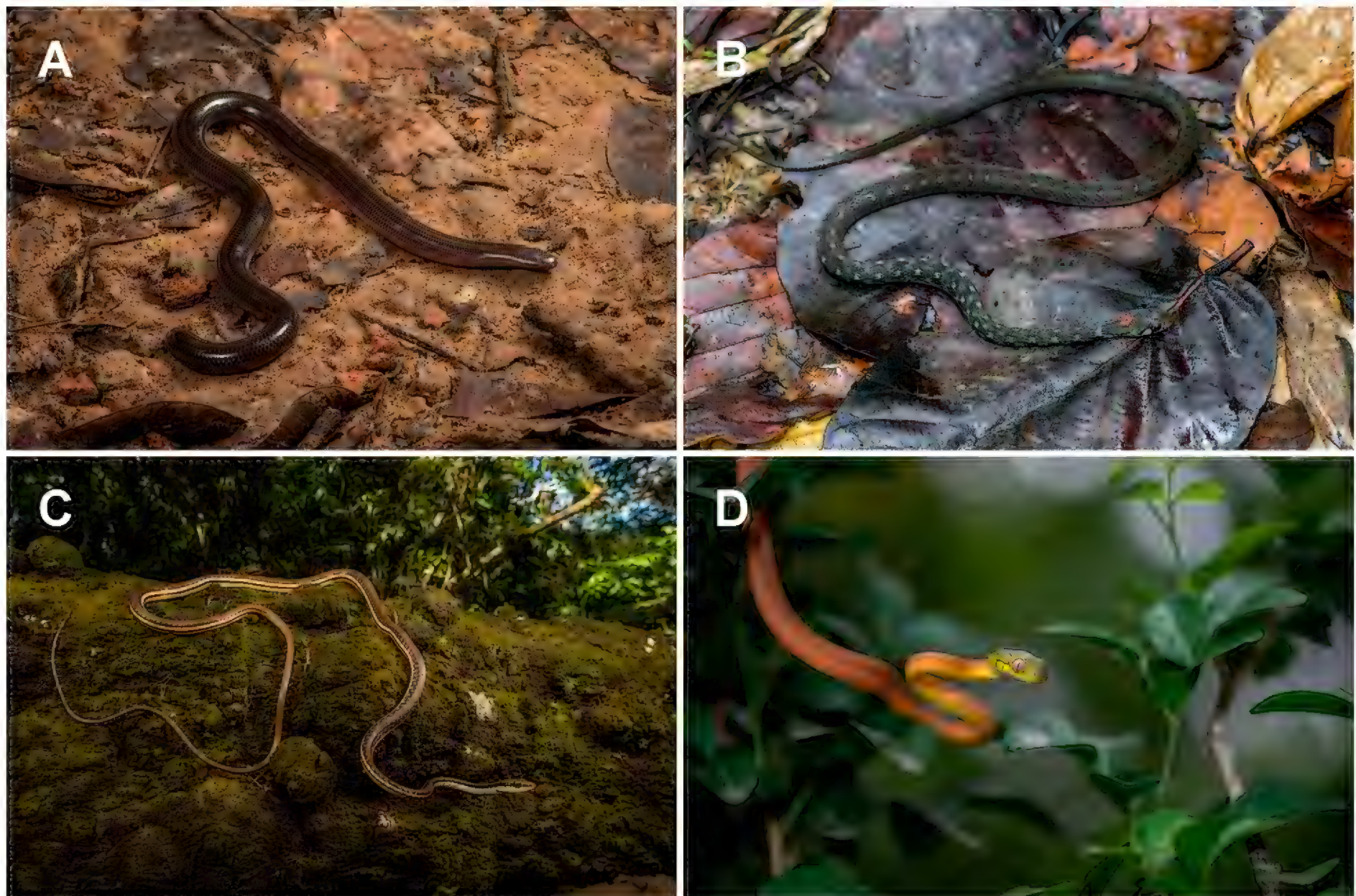


Figure 8. Some snakes of Lawachara National Park. **A.** *Argyrophis diardii* (ZRC(IMG) 2.339). **B.** *Rhabdophis himalayanus*. **C.** *Dendrelaphis proarchos* (ZRC(IMG) 2.352). **D.** *Boiga cyanea* – juvenile (ZRC(IMG) 2.341).

Habitat. Radio-tracked pythons utilized all habitats in the park but appear to favor highly degraded brushy habitat, tea plantation, and the outskirts of village habitat.

Remarks. On 11 May 2011, local villagers alerted us to an abandoned python nest in an old pangolin burrow in degraded forest (Rahman 2013). From 2013 to 2017, 10 *P. bivittatus* were captured by local villagers in LNP and given to the Creative Conservation Alliance, usually after a python had eaten one of their ducks. The captured pythons had radio-transmitters surgically inserted and were released back into LNP. Life history information from the radio-tracking study will be published in an upcoming paper. Human-python interactions involving domestic duck predation have become a serious issue for the sustainability of the python population in LNP, and the management of these conflicts is an ongoing issue.

Homalopsidae

Enhydris enhydris (Schneider, 1799)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, village near LNP; 24°20.28'N, 091°49.84'E; 19 Jun. 2013; 13:01; photo voucher ZRC(IMG) 2.354.

Identification. This water snake was identified by its small head, small eyes, top-situated nostrils, smooth scales with 21 midbody scale rows, robust body, dark dorsum with light yellowish stripes, and characteristic light brown lines on venter (Kabir et al. 2009).

Habitat. The only truly aquatic snake in LNP, it was usually found by fisherman as they dragged nets through the water in human-created habitats such as paddy fields and village ponds. It is possible that *E. enhydris* also occurs in water bodies in less degraded habitats which were not surveyed with nets.

Colubridae

Natricinae

Amphiesma stolatum (Linnaeus, 1758)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, rice paddy near Fulbari Village; 24°19.70'N, 091°48.84'E; 13 Jul. 2011; photo voucher ZRC(IMG) 2.337.

Identification. This was a slender brownish-olive keel-back identified by its two yellow or buff dorsolateral stripes which start indistinct in front and become very distinct on the rear 2/3 of the body, eight supralabials (III–V contacting orbit), and keeled scales with 19 midbody scale rows (Kabir et al. 2009).

Habitat. A common snake in the roadkill survey, *A. stolatum* was associated with various open habitats such as paddy fields, village habitat, and degraded forest.

Remarks. On 15 April 2012, SCR and KD observed a domestic chicken preying on an *A. stolatum* in a village on the park boundary (Rahman and Das 2014).

***Blythia reticulata* (Blyth, 1854)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Srimangal-Bhanugach Road; 24°19.85'N, 091°47.71'E; 12 Jul. 2011; photo voucher ZRC(IMG) 2.340.

Identification. *Blythia reticulata* is a small snake with dark iridescent scales, head not broader than neck and narrowing towards snout, six supralabials (III and IV contacting orbit), no loreal or preocular, and 13 midbody scale rows (Das 2010; Vogel et al. 2017). It was distinguished from the recently described *B. hmuifang* Vogel et al., 2017 by its black venter.

Taxonomic notes. Our discovery of *B. reticulata* in Bangladesh was first noted in Nature Quest (2012), but here we provide a submitted voucher for the first time. The occurrence is 102 km northwest of the closest previous locality in Sihhmui, Mizoram and 104 km south of the locality in Cherrapunji, Meghalaya (Vogel et al. 2017). *Blythia* was recently placed in the subfamily Natricinae on the basis of genetic data (Lalronunga et al. 2020).

Habitat. This highly fossorial snake showed up at times in the roadkill survey but has not yet been encountered alive by us. It was found in both mature and degraded forest.

***Fowlea piscator* (Schneider, 1799)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, rice paddy field near student dormitory; 24°20.16'N, 091°49.14'E; 12 Jul. 2013; 19:33; photo voucher ZRC(IMG) 2.380.

Identification. This is a medium-sized snake with checkered body pattern and yellowish head with two distinct black streaks across the mouth. Our specimens were missing the black barred collar found in *F. schnurrenbergeri* (Kramer, 1977) and had dark marks on the neck oriented away from the head rather than towards it as in *F. flavipunctatus* (Hallowell, 1860) (Vogel and David 2012).

Habitat. One of the more commonly observed snakes in LNP, we always found in or near aquatic habitats. While usually encountered in human-created habitats such as rice paddies and village ponds, it was also observed in small frog-heavy ponds in mature forest.

Remarks. SCR observed *F. piscator* regurgitate two *Duttaphrynus melanostictus* when palpated, and another regurgitated a live adult *Minervarya* sp. (Rahman et al. 2012c). On a third occasion *F. piscator* was observed preying upon a juvenile *H. tigrinus* (SVL 73 mm) but released it when disturbed by the human presence. All three regurgitated prey items, as well as the released frog, had been engaged leg first.

***Rhabdophis himalayanus* (Günther, 1864)**

Figure 8B

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP,

former Dhaka-Sylhet highway bisecting the park; 24°20.0'N, 091°48.0'E; 08 Jul. 2011; photo voucher ZRC(IMG) 2.154.

Identification. This keelback is a medium-sized snake typical of the genus *Rhabdophis*. With keeled dorsal scales, 19 midbody scale rows, eight supralabials (IV and V contacting orbit), a single preocular, three postoculars, 159–162 ventrals, 88–89 paired subcaudals, a black subocular stripe, and grey dorsal color with dual offset rows of pale dorsolateral spots, specimens from LNP keyed out to *R. himalayanus* (Das 2010). Specimens found in the park were atypical in having a lightly speckled rather than a black mottled venter and a dull orange, black-edged spot on top of the neck rather than the more typical yellow black-edged collar. These characteristics of the LNP specimens match those from Assam listed as “*Rhabdophis* sp.” by Das et al. (2009) and the JUHG0205 record from LNP mentioned by Mahony et al. (2009). Rahman and Ahmed (2012a) assigned these to *R. himalayanus*, with unusual color, and considered them to represent a moderate range extension.

Taxonomic notes. The presence of the species in LNP was published as a new Bangladesh country record (Rahman and Ahmed 2012a).

Habitat. One of the more common snakes in LNP, it was mainly associated with degraded and mature forest but could also be found at habitat edges near tea plantation, paddy fields and village habitat.

***Rhabdophis subminiatus* (Schlegel, 1837)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari Tea estate near Chevron Station; 24°19.59'N, 091°47.97'E; 22 Jul. 2011; 13:00; photo voucher ZRC(IMG) 2.374.

Identification. This is a medium-sized snake easily distinguished from other keelbacks by the thick black collar bordered at the back in yellow, extensive red neck, and olive-green body marked with black reticulations in juvenile and subadult specimens (Das 2010).

Habitat. *Rhabdophis subminiatus* was not common in LNP but was found occasionally in every habitat in the park.

Remarks. SCR observed an adult individual eating a *Minervarya* sp. (Rahman et al. 2012b). SCR observed another *R. subminiatus* exhibiting caudal autotomy when caught, a rare trait in snakes, but one which has been documented before in this genus.

Ahaetuliinae

***Ahaetulla prasina* (Boie, 1827)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°18.76'N, 091°46.67'E; 04 Jul. 2015; 21:22; photo voucher ZRC(IMG) 2.336.

Identification. This is a bright green snake with a long

slender body, elongated arrowhead-like head, and horizontal pupils, distinguished from the similar *A. nasuta* Lacepède, 1789 and the recently resurrected *A. anomala* Annandale, 1906 by the lack of a rostral appendage (Das 2010; Mohapatra et al. 2017).

Habitat. Within LNP, *A. prasina* was found in all non-aquatic habitats, taking advantage of trees and shrubs with access to sunlight at clearing edges.

Chrysopelea ornata (Shaw, 1802)

Material examined. BANGLADESH • 1 subadult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, road near Lawachara Station; 24°19.50'N, 091°47.24'E; 23 Jul. 2015; photo voucher ZRC(IMG) 2.347.

Identification. *Chrysopelea ornata* is an attractive greenish-yellow snake with black reticulations laterally, black crossbars on the upper dorsum with red dots between alternating pairs of crossbars, and distinct head with black and greenish-yellow bars (Daniel 2002; Whitaker and Captain 2008). There are nine supralabials with V and VI contacting the orbit.

Habitat. This snake was uncommonly seen in LNP, found only twice in the roadkill study and once on a roadside during an opportunistic search. The three individuals were found in mature forest, degraded forest, and tea plantation.

Dendrelaphis proarchos (Wall, 1909)

Figure 8C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, pond near Lawachara Station; 24°19.46'N, 091°47.30'E; 7 Jun. 2016; 20:13; photo voucher ZRC(IMG) 2.352.

Identification. *Dendrelaphis proarchos* is a slender brown snake with a thick black eye stripe that starts behind the eye and continues onto the neck, bright cream ventrolateral stripe bordered on both sides by black, and blue coloration on the neck skin that shows more prominently when agitated (Vogel and Van Rooljen 2011). Our specimens had 9–10 supralabials (IV–VI or VI and VII contacting orbit), loreal present, one preocular, 2–3 postoculars, and 2+2+2 or 2+1+2+2 temporals. They were distinguished from *D. tristis* (Daudin, 1803) by the red tongue (Whitaker and Captain 2008).

Taxonomic notes. *Dendrelaphis pictus* populations west of Burma were assigned to *D. proarchos* by Vogel and Van Rooljen (2011). This is considered to be an accurate determination (Jayaditya Purkayastha pers. comm.), although it is yet to be fully accepted due to the lack of a clear description of *D. proarchos* (Peter Uetz pers. comm.).

Habitat. This species was found at habitat edges in both mature forest and degraded habitats, such as on dirt banks bordering tea plantation and village habitat or on brush edging degraded forest that bordered the road.

Colubrinae

Boiga cyanea (Duméril et al., 1854)

Figure 8D

Material examined. BANGLADESH • 1 juvenile; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, pond south of Janki Chora; 24°18.76'N, 091°46.88'E; 12 Jun. 2014; 20:43; photo voucher ZRC(IMG) 2.341.

Identification. A long, slender cat snake with large head, vertical pupil, eight supralabials, and 21 midbody scale rows. One specimen in the park had 253 ventral scales and 125 subcaudals. This is the only *Boiga* species in the region with a green dorsal color in adults and rust color with green head in juveniles (Kabir et al. 2009).

Habitat. *Boiga cyanea* was one of the most regularly seen snakes during nocturnal visual surveys of mature forest. It was usually found moving at 1–2 m above the ground in dense vegetation, although occasionally it was forced to the ground during heavy rains. No specimens were found outside of mature forest.

Remarks. In contrast to the frequency with which we encountered *B. cyanea* in our visual surveys, this species was only found once in 14 months in the road-kill survey. This disparity may be due to its affinity for dense forest and reluctance to leave vegetation to cross roads, or possibly faster speeds in crossing roads may minimize casualties. JH observed a large adult that had been killed during the day by local villagers while expanding their betel vine plantation into mature forest.

Boiga gocool (Gray, 1835)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari Tea Garden bordering LNP; 24°19.18'N, 091°48.19'E; 16 Jun. 2011; 11:00; photo voucher ZRC(IMG) 2.342.

Identification. Specimens were identified by 21 midbody scale rows, vertical Y-shaped markings on the dorsal surface separated by light vertebral line, lack of white spots on the lateral surface, and a characteristic arrowhead-shaped mark on top of the head (Whitaker and Captain 2008).

Habitat. This cat snake was found in mature forest, degraded forest, tea plantation, and paddy fields. Though we only sighted a few specimens, there was some suggestion that it favored habitat near marsh and paddy edges.

Boiga ochracea walli (Smith, 1943)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, former Dhaka-Sylhet highway bisecting the park; 24°20.0'N, 091°48.0'E; 13 Jul. 2011; photo voucher ZRC(IMG) 2.156.

Identification. This is a medium-sized cat snake with eight supralabials, one preocular, two postoculars, 19 midbody scale rows with a greatly enlarged hexagonal vertebral row, and patternless tawny coloration with the

head the same color as the body (Das 2010). At least one specimen was found with supralabials III–V in contact with orbit, rather than the usual IV–VI stated in the published description. Another specimen was observed with light markings reminiscent of *B. gocool*.

Taxonomic notes. The presence of *B. ochracea walli* in LNP was published as a range extension from Sylhet District (Rahman 2012a).

Habitat. In LNP, *B. ochracea walli* was primarily found in degraded forest, with only a couple of specimens found in other habitats.

Boiga siamensis Nutphand, 1971

Material examined. BANGLADESH • 1; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari Tea Estate bordering LNP; 24°19.9'N, 091°48.0'E; 17 Jun. 2011; photo voucher ZRC(IMG) 2.155.

Identification. This species was differentiated from other cat snakes by angled brown bands on the dorsal and lateral surfaces, distinct white spots on the flanks, eight supralabials (III–V contacting orbit), one preocular, two postoculars, and the lack of an arrowhead-like marking on the head (Das 2010).

Taxonomic notes. The presence of *B. siamensis* in LNP was published as the first confirmed record from Bangladesh (Rahman 2012b).

Habitat. In LNP this was the cat snake most often found in tea plantation, though it was also found in both mature and degraded forest.

Coelognathus radiatus (Boie 1827)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, eastern Chevron guard station; 24°19.95'N, 091°47.80'E; 16 Jun. 2015; 13:16; photo voucher ZRC(IMG) 2.395.

Identification. This is a large, brownish rat snake identified by three black lines that radiate from the eye and four black stripes on the front of the body that fade towards the back (Kabir et al. 2009).

Habitat. We encountered this species in low numbers in all habitats in LNP. On occasion it would wander into homes and be the subject of village “snake calls.”

Lycodon aulicus (Linnaeus, 1758)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, paddy field east of Fulbari Village; 24°19.72'N, 091°48.70'E; 20 Jun. 2014; 22:50; photo voucher ZRC(IMG) 2.343.

Identification. This common *Lycodon* species is distinguished from other local wolf snakes by its relatively broad head, loreal in contact with internasal, 17 midbody scale rows, brownish-gray dorsal color with indistinct white-to-cream reticulations forming bands in the front of the body that fade towards the back, and light collar reaching towards front of head (Ganesh and Vogel 2018).

Habitat. Of the three *Lycodon* species found in LNP, *L. aulicus* was the one most associated with humans, found across all disturbed habitats but most commonly in village habitat and paddy fields.

Remarks. This snake was twice seen being preyed on by other species; SCR observed a 77 cm specimen being eaten by a 13 cm *Hoplobatrachus tigerinus* (Rahman et al. 2012a), and JH and ST observed another being consumed by a *Bungarus fasciatus*.

Lycodon jara (Shaw, 1802)

Figure 9A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail near Janki Chora; 24°18.79'N, 091°46.55'E; 5 Jul. 2015; 20:03; photo voucher ZRC(IMG) 2.361.

Identification. *Lycodon jara* is a small brown snake with flattened head and eight supralabials (III–V contacting orbital), identified by two brilliant yellow-green dots on each dorsal scale (Whitaker and Captain 2008).

Habitat. This snake was found in mature forest, degraded forest, and tea plantation.

Lycodon zawi Slowinski et al., 2001

Figure 9B

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Lawachara Station; 24°19.64'N, 091°47.03'E; 12 Jun. 2014; photo voucher ZRC(IMG) 2.362.

Identification. We distinguished *L. zawi* from other wolf snakes in LNP by its 17 smooth midbody scale rows, dark-brown dorsum with 18–22 narrow and widely separated white bands without intervening reticulations or crossbands, nine supralabials (IV and V contacting orbit), 1–2 preoculars, loreal scale not in contact with internasal or orbit, and lack of pale collar on the neck or nape (Slowinski et al. 2001).

Habitat. This species appeared most frequently in mature forest, although we found some road-killed specimens in degraded forest.

Oligodon albocinctus (Cantor, 1839)

Figure 9C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°18.77'N, 091°46.66'E; 10 Jul. 2015; 20:03; photo voucher ZRC(IMG) 2.364.

Identification. This is a typical kukri snake with cream V-shaped face mark; it is the only species in the region to show distinct narrow pale crossbars outlined in black that repeat regularly on the body (Das 2010; Vivek Sharma pers. comm.). Our specimens can be differentiated from the endemic Cambodian *O. kampucheaensis*, the endemic Thai *O. saiyok*, and the red phase of the Sundaland species *O. purpurascens* by the presence of 30+ dorsal rings (17 in *O. kampucheaensis*, 10–18 in *O. purpurascens*, 21–22 in *O. saiyok*), seven supralabials

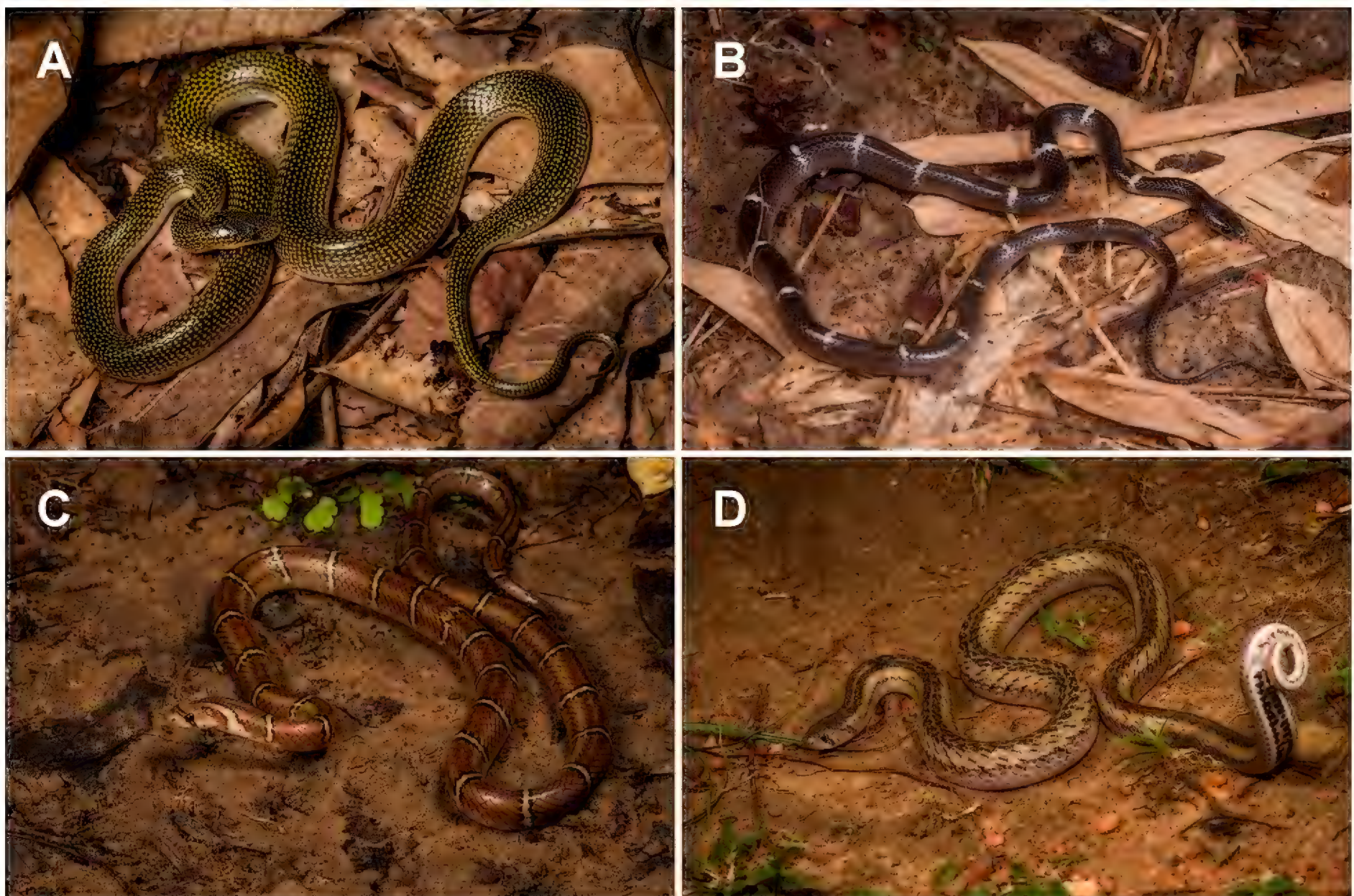


Figure 9. Some snakes of Lawachara National Park. **A.** *Lycodon jara* (ZRC(IMG) 2.361). **B.** *Lycodon zawi* (ZRC(IMG) 2.362). **C.** *Oligodon albocinctus* (ZRC(IMG) 2.364). **D.** *Oligodon cyclurus*.

with III and IV in contact with eye (eight and IV–V in *O. kampucheaensis*, *O. purpurascens*, and *O. saiyok*), 19 midbody scale rows (15 in *O. kampucheaensis*, 17 in *O. saiyok*), and known species range (Neang et al. 2012; Hasan et al. 2013; Sumontha et al. 2017).

Taxonomic notes. The presence of *O. albocinctus* in LNP was noted in Rahman et al. (2013b), although there was no voucher provided. We present the first vouchered record from Sylhet Division, which is 100 km south of the closest recorded locality in Cherrapunji, Assam (Hasan et al. 2013; Uetz 2020).

Habitat. This species was found both in mature and degraded forest in LNP.

Oligodon cyclurus (Cantor, 1839)

Figure 9D

Material examined. BANGLADESH • 1; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari Village near LNP; 24°19.9'N, 091°48.8'E; 22 Jul. 2011; 07:00; photo voucher ZRC(IMG) 2.158a. • 1; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, former Dhaka-Sylhet highway bisecting the park; 24°20.0'N, 091°48.0'E; 24 Oct. 2011; photo voucher ZRC(IMG) 2.158b. • 1, 46.5 cm adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, road near Fulbari Village; 24°20.17'N, 91°49.14'E; 13 Jun. 2014; 21:15; photo voucher ZRC(IMG) 2.365.

Identification. This medium-sized snake was identified as a kukri snake by its stocky robust body and

characteristic “kukri snake” facemask with dark brown V-shaped markings. It was assigned to *O. cyclurus* due to 19 midbody scale rows, one preocular, two postoculars, yellowish-brown body with darker brown markings in rows which combine to form two dorsal stripes, and pink venter with white on the outer margins of the ventrals (Das 2010; David et al. 2011). Our two examined specimens had seven supralabials (III and IV contacting orbit), 177/184 ventrals, and 43/61 subcaudals, which places them at the limits of published descriptions (eight or sometimes seven supralabials with IV and V contacting the orbit, 161–185 ventrals, and 36–58 subcaudals) (Das 2010; David et al. 2011).

Taxonomic notes. The presence of this species in LNP was published as the first record from Sylhet Division (Rahman 2012c).

Habitat. We found *O. cyclurus* only in degraded forest in LNP.

Oligodon dorsalis (Gray & Hardwicke, 1835)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Wildlife Rescue and Rehabilitation Center at Janki Chora; 24°18.98'N, 091°46.61'E; 19 Jul. 2013; 13:01; photo voucher ZRC(IMG) 3.366.

Identification. *Oligodon dorsalis* is a gray to brown snake with a distinctly dark head, light-brown dorsal stripe outlined by darker stripes, a thin, dark lateral stripe, and large black spots on the tail. Superficially,

this species is similar to *O. taeniatus*, but our specimens were differentiated by having seven supralabials (III and IV contacting orbit), 15 midbody scale rows, a divided anal, and a black-and-white venter with red only on the subcaudals (Daniel 2002; Das 2010).

Habitat. This was the *Oligodon* species in LNP most associated with mature forest, though it also was occasionally found in degraded forest. One specimen was observed by ST active during a sunny day, an unusual behavior for a kukri snake.

Oreocryptophis porphyraceus (Cantor, 1839)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Srimangal-Bhanugach Road near Fulbari Tea Estate; 24°19.92'N, 091°47.88'E; 3 Aug. 2011; photo voucher ZRC (IMG) 3.367.

Identification. *Oreocryptophis porphyraceus* is an unmistakable reddish-brown (one specimen) or tan (one specimen) snake with broad, dark-reddish crossbands lined with black, two thin, black dorsolateral stripes on the rear portion of the body, and a black postocular stripe on each side of the head split by a narrow, black line on the top of the head (Whitaker and Captain 2008).

Taxonomic notes. This species was reported by us for the first time from Bangladesh (Nature Quest 2012), but without any associated specimen record. Here we provide the first vouchered record, which is 110 km northwest of the nearest reported locality in Vensang, Mizoram (Harit 2016). This record, at 50 m above sea level, is the first time that *O. porphyraceus* has been found at an elevation below 1,000 m (Whitaker and Captain 2008; Harit 2016).

Habitat. This beautiful snake was found twice during the late monsoon, once in the roadkill survey and once in an opportunistic collection after it had been killed by a human. Both specimens were found in mature forest.

Ptyas korros (Schlegel, 1837)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, Fulbari tea estate bordering LNP; 24°19.53'N, 091°49.03'E; 15 Jun. 2011; photo voucher ZRC(IMG) 3.370.

Identification. *Ptyas korros* is a large, brownish rat snake with black edging on the scales of the hind body. It is differentiated from *P. mucosa* by the lack of black lines between the subcaudals, the lack of dark bands on the posterior portion of the body, and a dark ring encircling the pupil (Whitaker and Captain 2008).

Habitat. This rat snake was seen regularly by us in all habitats in LNP.

Remarks. On 28 June 2015, JH observed a *Paguma larvata* (Hamilton-Smith, 1827) at a height of ~7 m in a tree feeding on a ~1.5 m long *P. korros*. *Ptyas korros* was never recorded in the roadkill survey. It may be more wary of roads or may cross them quickly, but it is possible that humans or scavengers, such as jackals and civets, remove these large snakes from the road more frequently

than small snakes.

Ptyas mucosa (Linnaeus, 1758)

Material examined. BANGLADESH • 1 juvenile; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP; near student dormitory; 24°19.33'N, 091°48.98'E; 14 Jul. 2011; 17:00; photo voucher ZRC(IMG) 3.371.

Identification. *Ptyas mucosa* is a large, brownish rat snake with black edging the scales of the hind body. It is differentiated from *P. korros* by the dark bands on the posterior portion of its body, strong black lines between the subcaudals, and lack of a dark ring around the pupil (Whitaker and Captain 2008). Vouchered specimen had eight supralabials (IV and V contacting orbit), three loreals, one preocular, one presubocular, two postoculars, and temporals 2+2.

Habitat. In LNP we found this species in degraded forest, tea plantation, and village habitat.

Sibynophiinae

Sibynophis collaris (Gray, 1853)

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, on trail near Janki Chora; 24°18.85'N, 091°47.15'E; 10 Aug. 2011; 15:00; photo voucher ZRC(IMG) 3.375.

Identification. *Sibynophis collaris* is a slender brown snake with a slate-gray head, white supralabials, black nuchal mark on collar bordered behind with cream, and black spots forming a line on each side of a light venter. It differs from *S. triangularis* in having the black nuchal mark not triangular (Das 2010).

Taxonomic notes. The presence of *S. collaris* in LNP was published as the first confirmed country record in Bangladesh (Rahman and Ahmed 2012b).

Habitat. We usually found this species in mature forest, but sometimes it was found in disturbed forest, and one roadkill was adjacent to paddy fields.

Pareatidae

Pareas monticola (Cantor, 1839)

Figure 10A

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail behind Janki Chora; 24°18.65'N, 091°46.53'E; 24 Jun. 2015; 19:43; photo voucher ZRC(IMG) 3.368.

Identification. This is a small, slender slug snake identified by its characteristic stout head with short blunt nose, seven supralabials, black double eye stripe, and indistinct dark bars on brown dorsum (Das 2010). One of our specimens was unusual for *P. monticola* in having two preoculars and a subocular which prevents either the loreal or the supralabials from contacting the orbit.

Habitat. We often found *P. monticola* in the mature forest, both on the forest floor and sitting on vegetation 30–120 cm above the ground. Specimens were also found in



Figure 10. Some snakes of Lawachara National Park. **A.** *Pareas monticola* (ZRC(IMG) 2.368). **B.** *Psammodynastes pulverulentus* (ZRC(IMG) 2.369). **C.** *Bungarus fasciatus* feeding on *Lycodon aulicus* (ZRC(IMG) 2.343). **D.** *Trimeresurus erythrurus*.

degraded forest.

Lamprophiidae

***Psammodynastes pulverulentus* (Boie, 1827)**

Figure 10B

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail at Janki Chora; 24°18.75'N, 091°46.66'E; 5 Jul. 2015; 21:38; photo voucher ZRC(IMG) 3.369.

Identification. The voucher specimen was brown with dark-brown and tan dorsal markings, obscure, light dorsolateral stripes, and a dark-brown dorsal facemask composed of symmetrical lines which came together behind the head as described by Kabir et al. (2009). The head was broad and vaguely reminiscent of a viper. Other individuals found in the park showed considerable variation, with the dorsum varying from brown to gray and distinctly striped in some. The symmetrical lines on the face and shape of the head shape are unique to *P. pulverulentus* and were similar in all specimens that we observed. Our specimens showed variation in head sculation, with eight supralabials (III-V in contact with the orbit), 1–2 loreals, 1–2 preoculars, and 2–3 postoculars.

Habitat. In our roadkill survey, *P. pulverulentus* was the most common non-typhlopoid, with 57 individuals found dead on the road in 14 months. This species was found in all habitats, but most were in forest.

Elapidae

***Bungarus fasciatus* (Schneider, 1801)**

Figure 10C

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, rice paddy east of Fulbari Village; 24°19.72'N, 091°48.70'E; 20 Jun. 2014; 22:50; photo voucher ZRC(IMG) 3.343.

Identification. *Bungarus fasciatus* has a triangular body with large vertebral scales, a black head and nape with a yellow “V” that does not connect at the apex on the top of the head, and distinct, broad, black-and-yellow, approximately equally sized bands (Khan 2008). The voucher specimen had 31 yellow bands.

Habitat. This was the krait most associated with human-modified habitats in LNP and was usually found in village habitat, tea plantation, paddy fields, and degraded forest.

Remarks. One specimen was observed by JH and ST in a fallow rice paddy as it consumed a *Lycodon aulicus*.

***Bungarus niger* (Wall, 1908)**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail behind Janki Chora; 24°18.48'N, 091°46.82'E; 19 Jun. 2015; 21:11; photo voucher ZRC(IMG) 3.344.

Identification. The iridescent black color and lack of dorsal markings in this species distinguish it from other local kraits (Khan 2008). The voucher specimen had 204

ventral scales and 53 subcaudals, ruling out *B. lividus* which has 209–221 ventrals and only 35–43 subcaudals (Kabir et al. 2009; Das 2010). Vertebral scales were large and hexagonal in shape.

Habitat. We found *B. niger* in both mature and degraded forest. On rare occasions it appeared in village habitat.

***Naja kaouthia* Lesson, 1831**

Material examined. BANGLADESH • 1 adult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, Chevron station; 24°19.85'N, 091°47.71'E; 11 Jun. 2011; photo voucher ZRC(IMG) 2.402.

Identification. *Naja kaouthia* is a large brown cobra, which in northeast Bangladesh lacks rings; the head is broad and there is a unique monocle marking on the back of the hood (Das 2010). The throat of the vouchered specimen was yellowish tan with a pale, slightly mottled section from ventrals 9–14 and a progressively darker gray section from ventrals 15–22.

Habitat. This is primarily a snake of tea plantations and degraded forest in LNP, though it was occasionally observed in paddy fields and village habitat.

Remarks. SCR observed one instance of a *N. kaouthia* spitting venom, an unusual but not unknown behavior among species of *Naja*.

***Ophiophagus hannah* (Cantor, 1836)**

Material examined. BANGLADESH • 1 subadult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, trail behind Janki Chora; 24°19.42'N, 091°47.44'E; 15 Apr. 2013; photo voucher ZRC(IMG) 2.398.

Identification. *Ophiophagus hannah* is distinguished from the other cobras in the region by its large size (>2 m long), large head, and banded body (Das 2010).

Habitat. Despite its large size, *O. hannah* was a rarely encountered snake in LNP, with only five sightings during our survey. The sightings were in mature forest, tea plantation, and village habitat.

Remarks. One *O. hannah* in a tea plantation was observed eating *Coelognathus radiatus*. Another individual in mature forest was observed by KD immediately after it had bitten a domestic dog, which then died.

***Sinomicrurus macclellandi* (Reinhardt, 1844)**

Material examined. BANGLADESH • 1; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP, former Dhaka-Sylhet highway bisecting the park; 24°19.8'N, 091°47.5'E; 26 Oct. 2011; photo voucher ZRC(IMG) 2.157.

Identification. This is a slender, reddish-brown elapid with short, narrow, black bars on the dorsum (41 in one specimen) and a black head with a broad, cream-colored band across the top of the head in line with the eyes (Das 2010).

Taxonomic notes. The first confirmed record of *S. macclellandi* in LNP and Bangladesh was published by Rahman (2012d).

Habitat. We did not commonly find this species in LNP, where it was limited to mature and degraded forest.

Crotalidae

***Trimeresurus erythrurus* (Cantor, 1839)**

Figure 10D

Material examined. BANGLADESH • 1 subadult; Sylhet Division, Moulvibazar District, Kamalganj Upazila, LNP; trail behind Janki Chora; 24°18.61'N, 091°46.71'E; 13 Jun. 2014; 19:42; photo voucher ZRC(IMG) 2.378.

Identification. This is a medium-sized viper identified by its green color, brown-spotted tail, keeled temporal scales, and 23 midbody scale rows (Das 2010).

Taxonomic notes. *Trimeresurus* were common in the roadkill survey, but many specimens were too damaged to identify to species, and the rest were identified at the time as *T. albolabris*, which we now believe were misidentifications. The *Trimeresurus* found in LNP during the nocturnal visual surveys since 2014 were definitively identified as *T. erythrurus*, but it is possible that additional green pit viper species are present in the park.

Habitat. This species was typically encountered in mature and degraded forest, although several specimens also showed up in tea plantations. It was usually found hanging motionless from low vegetation, waiting for prey. On occasion specimens were found on the ground during heavy rains.

Discussion

Our study increased the known herpetofaunal species richness of LNP to 71 species. Of these species, 49% are snakes. It is certain that additional species remain to be found. While 80% of our list was found in the study's first year, only in the fifth year did we observe *Raorchestes rezakhani* and *Chikila fulleri* for the first time, and it was not until the study's sixth year that we identified a potentially novel species of *Takydromus*.

Additional species likely to be found in LNP include *Oligodon cinereus* (Günther, 1864), one of which was tentatively identified during the road-kill survey but could not be confirmed, and *Oligodon taeniolatus* (Jerdon, 1853), which was not found in our surveys but has been reported by Mahony et al. (2009) from Kamalganj, just a few kilometers east of LNP. The late Tania Khan photographed in a mature forest stream of LNP a small snake which appears to be a juvenile *Herpetoreas xenura* (Wall, 1907), although without a specimen this identification cannot be confirmed (Gernot Vogel pers. comm.). A bird photographer, Sayem Chowdhury, took photos of three *Draco* in the upper canopy of mature forest which could not be identified to species. We captured numerous small *Minervarya* individuals which correspond to at least one or possibly two species not in the current list.

Several of the species that we document represent important range extensions. *Micryletta aishani*, *Hylarana tyleri*, *Feihyla hansenae*, *Blythia reticulata*,

Table 1. Observed habitats where amphibians were recorded in Lawachara National Park.

Taxa	Mature forest	Degraded forest	Tea plantation	Paddy fields	Village habitat
AMPHIBIA					
ANURA					
Megophryidae					
<i>Leptobrachium smithi</i>	X	X			
Microhylidae					
<i>Kaloula pulchra</i>	X	X	X		X
<i>Microhyla berdmorei</i>	X	X	X		X
<i>Microhyla mymensinghensis</i>	X	X	X	X	X
<i>Micryletta aishani</i>	X				X
Dicroglossidae					
<i>Euphlyctis cyanophlyctis</i>	X	X	X	X	X
<i>Minervarya pierrei</i>	X	X			
<i>Fejervarya orissaensis</i>				X	X
<i>Hoplobatrachus tigerinus</i>		X	X	X	X
Ranidae					
<i>Clinotarsus alticola</i>	X	X			
<i>Hydrophylax leptoglossa</i>	X	X	X	X	
<i>Hylarana tytleri</i>					X
Rhacophoridae					
<i>Chirixalus doriae</i>	X	X	X	X	
<i>Feihyla hansenae</i>	X	X			X
<i>Polypedates teraiensis</i>	X	X	X	X	X
<i>Raorchestes rezakhani</i>	X				
<i>Rhacophorus bipunctatus</i>	X				
<i>Theloderma baibungense</i>	X				
Bufonidae					
<i>Duttaphrynus melanostictus</i>	X	X	X		X
GYMNOPHIONA					
Caeciliidae					
<i>Chikila fulleri</i>	X				

Oligodon albocinctus, and *Oreocryptophis porphyraceus* are confirmed here from Sylhet Division for the first time; *M. aishani*, *F. hansenae*, *B. reticulata*, and *O. porphyraceus* are newly recorded from Bangladesh. *Theloderma baibungense* and *Chikila fulleri* are also newly reported from the country; these species were originally sighted by Tania Khan and are published here for the first time. *Raorchestes rezakhani*, a species still undescribed when we first encountered it in 2015, has now been described by other researchers (Al-Razi et al. 2020). Including species we have published in previous papers (Rahman 2012a, 2012b, 2012c, 2012d; Rahman and Ahmed 2012a, 2012b; Ghose et al. 2016), 16 range extensions, including 11 new species in Bangladesh, have been revealed over the six-year course of our LNP survey.

Twenty-three species previously thought to be present in LNP are removed from the herpetofauna of this park. *M. ornata*, *F. limnocharis*, *P. leucomystax*, *C. ayeyarwadyensis*, and *D. pictus* have been supplanted by the description of new species within their species complexes; *R. htunwini* has been placed into synonymy

Table 2. Observed habitats where reptiles were recorded in Lawachara National Park.

Taxa	Mature forest	Degraded forest	Tea plantation	Paddy fields	Village habitat
REPTILIA					
CHELONII					
Geoemydidae					
<i>Cyclemys gemeli</i>	X				
Testudines					
<i>Indotestudo elongata</i>	X	X			
SQUAMATA					
SAURIA					
Gekkonidae					
<i>Cyrtodactylus tripuraensis</i>	X		X		
<i>Gekko gekko</i>	X	X	X		X
<i>Hemidactylus frenatus</i>	X	X	X		X
<i>Hemidactylus platyurus</i>	X	X			X
Scincidae					
<i>Eutropis macularia</i>	X	X	X		
<i>Eutropis multifasciata</i>		X	X		X
<i>Riopa albopunctata</i>			X		X
<i>Sphenomorphus maculatus</i>	X	X	X		X
Lacertidae					
<i>Takydromus khasiensis</i>	?				
Agamidae					
<i>Calotes emma</i>	X				
<i>Calotes versicolor</i>	X	X	X		X
<i>Ptyctolaemus gularis</i>	X				
Varanidae					
<i>Varanus bengalensis</i>	X	X	X	X	X
<i>Varanus salvator</i>		X			
SERPENTES					
Typhlopidae					
<i>Argyrophis diardii</i>	X	X	X		X
<i>Indotyphlops braminus</i>	?	?	?		X
Pythonidae					
<i>Python bivittatus bivittatus</i>	X	X	X	X	X
Homalopsidae					
<i>Enhydrys enhydrys</i>				X	X
Colubridae					
Natricinae					
<i>Amphiesma stolatum</i>		X		X	X
<i>Blythia reticulata</i>	X	X			
<i>Fowlea piscator</i>	X			X	X
<i>Rhabdophis himalayanus</i>	X	X	X	X	X
<i>Rhabdophis subminiatus</i>	X	X	X	X	X
Ahaetuliinae					
<i>Ahaetulla prasina</i>	X	X	X		X
<i>Chrysopelea ornata</i>	X		X		X
<i>Dendrelaphis proarchos</i>	X	X	X		X
Colubrinae					
<i>Boiga cyanea</i>	X				
<i>Boiga gocoool</i>	X	X	X	X	
<i>Boiga ochracea walli</i>	X	X	X		
<i>Boiga siamensis</i>	X	X	X		
<i>Coelognathus radiatus</i>	X	X	X	X	X
<i>Lycodon aulicus</i>		X	X	X	X
<i>Lycodon jara</i>	X	X	X		
<i>Lycodon zawi</i>	X	X			

Table 2. Continued.

Taxa	Mature forest	Degraded forest	Tea plantation	Paddy fields	Village habitat
<i>Oligodon albocinctus</i>	X	X			
<i>Oligodon cyclurus</i>		X			
<i>Oligodon dorsalis</i>	X	X			
<i>Oreocryptophis porphyraceus</i>	X				
<i>Ptyas korros</i>	X	X	X	X	X
<i>Ptyas mucosa</i>		X	X		X
Sibynophiinae					
<i>Sibynophis collaris</i>	X	X		X	
Pareatidae					
<i>Pareas monticola</i>	X	X			
Lamprophiidae					
<i>Psammodynastes pulverulentus</i>	X	X	X	X	X
Elapidae					
<i>Bungarus fasciatus</i>		X	X	X	X
<i>Bungarus niger</i>	X	X			X
<i>Naja kaouthia</i>		X	X	X	X
<i>Ophiophagus hannah</i>	X		X		X
<i>Sinomicrurus macclellandi</i>	X	X			
Crotalidae					
<i>Trimeresurus erythrurus</i>	X	X	X		

with *R. bipunctatus*; *O. cinereus* could not be conclusively confirmed; and *M. rubra*, *F. teraiensis*, *H. taipehensis*, *C. simus*, *C. vittatus*, *R. punctata*, *S. reevesii*, and *T. albolabris* are believed to have been erroneously reported due to misidentifications. The checklist by Reza and Perry (2015) also reported *Hemidactylus bowringii* (Gray, 1845), *Hemidactylus brookii* Gray, 1845, *Hemidactylus garnotii* Duméril & Bibron, 1836, *Eutropis carinata* (Schneider, 1801), *Lygosoma bowringii* Günther, 1864, *Lygosoma lineolatum* (Stolizcka, 1870), *Oligodon taeniolata* (Jerdon, 1853), and *Dendrelaphis tristis* from LNP but did not provide documentation for these records (AHM Ali Reza pers. comm.). We consider them unconfirmed until photographs or specimens are available.

Our survey revealed important life history details for many species, resulting in three full-length publications and five life history notes (Rahman et al. 2012a, 2012b, 2012c, 2013a, 2013b; Rahman 2013; Rahman and Das 2014; Trageser et al. 2017), with more publications in preparation. These results and ongoing work in other regions will provide the basis for a field guide to Bangladesh’s herpetofauna, ideally to be completed soon.

Many other species may have remained undetected, especially fossorial reptiles and amphibians such as *Uperodon* Duméril & Bibron, 1841, *Kalophrynus* Tschudi, 1838; species of *Kaloula*, *Gymnophiona*, *Riopa*, and *Typhlopidae*; canopy-dwelling species such as *Rhacophorus* and *Boiga*; and stream-inhabiting species including *Amolops* Cope, 1865 and *Tropidophorus* Duméril & Bibron, 1839. Drift-fence arrays, arboreal snake traps, closed-foam active traps, and PVC pipe active traps may

be fruitful in revealing additional species, but within the park these methods present logistic and regulatory challenges. There is also the possibility for cryptic species to be identified within known populations, especially in the genera *Chirixalus*, *Minervarya*, *Hoplobatrachus*, *Polypedates*, *Hemidactylus*, *Takydromus*, *Indotyphlops*, *Dendrelaphis*, and *Trimeresurus*. We welcome further investigation by specialists in those taxa to resolve identity questions and contribute to the growing knowledge of herpetofauna in Bangladesh.

The characterization of herpetofauna in LNP is a race against time. Our field experience found 57 of the 71 species listed in our survey in mature forest, including 22 species which rarely or never appeared outside of that habitat. This mature forest (itself just moderately older former plantation land) occupies only 400 ha of park space and is under threat from illegal logging, the harvest of non-timber forest products, and infrastructure projects in the name of tourism development. Even those species utilizing degraded forest habitats face threats, as the forest continues to be cleared for lime plantations and betel leaf cultivation. Illegal hunting within the park targets several vulnerable species, including *Cyclemys gemeli*, *Indotestudo elongata*, *Varanus bengalensis*, and *Varanus salvator*. Human–wildlife conflicts result in the loss of the most conspicuous species of snakes, especially *Python bivittatus*, *Naja kaouthia*, and *Ophiophagus hannah*. The herpetological diversity cataloged here will only be sustained so long as concerned individuals and organizations, park management, and local villagers are able to work together to manage the park’s limited resources in the most environmentally-sound manner possible.

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We would like to dedicate this manuscript to the late Chirag Roy, an essential advisor, field assistant, and friend in the early years of the project, who passed away in Tadoba Andheri Tiger Reserve in Maharashtra in 2016 from a cobra bite.

Authors' Contributions

SCR, ST, and SMAR conceived the idea and founded the project. SCR, ST, KD, JH, and AG led the field efforts. JH, ST, and SCR confirmed the taxonomic identity of all specimens. JH wrote the text with contributions from ST.

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